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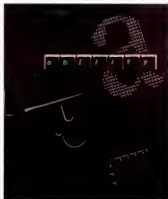
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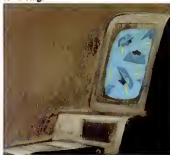
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● John M. Woram continues his series on BASIC programs with a look at True BASIC from Addison-Wesley Publishing Company.

● The News reports on *Fortune's* survey of American businesses that explains why the IBM PC is the machine of choice for corporate computer users.

● An interview with a disgruntled West-Coast software dealer reveals how heads will roll when Lotus lowers the boom—and lifts a dealership's sales rights.

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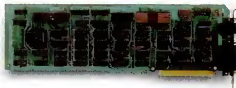
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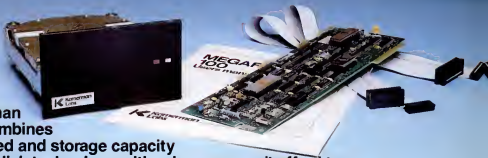
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What's Inside

PC's "Dr." Michael O'Conne uses his technical expertise to fix computers in novel ways. The editors would like to put his know-how into one of this issue's expert systems.

Dr. Michael O'Conne, TC (technical coordinator), strode like an eminent surgeon through the halls of *PC Magazine*, his tool box dangling loosely from his left fist. As he passed, advertising sales people glanced at him respectfully, and editors whispered each other, "Dr. O'Conne is on another case."

As he reached the office of associate editor Stephanie Stallings, he smoothed his distinguished blond beard and opened the door. Stallings, clutching a damp handkerchief, jumped from her chair. "Oh, Dr. O'Conne," she cried. "Thank the Lord you're here. It's my Compaq Deskpro—it won't recognize the B: drive."

O'Conne smiled at her reassuringly, placed himself in front of the computer, examined the screen, and hit the Return key. The machine gave a small whirr, began to hum, and then settled down again into silence.

O'Conne frowned. He typed a few more commands into the computer and examined the screen carefully. "Doctor," Stallings whispered. "Tell me the truth? Is it fatal? Will I have to . . . to send it to the shop?"

At first, there was no answer. There was only the sound of the little computer bravely trying to switch into the B: drive and failing miserably.



Expert Treatment

Then suddenly, in a swift, expert movement, O'Conne lifted his fist and hit it sharply against the side of the machine. For a moment, all was silent—and then, suddenly, the B: drive light flicked on, and the comforting grind of an operating disk drive filled the room.

Dr. O'Conne rose majestically, nodded to the grateful editor, and left. However, just before he passed through the door, he turned and pronounced, "There is a place for physical force in technology."

What Really Happened

Okay, so I've embroidered a little. O'Conne is really a very nice, rather mod-

est guy who has a way with machines. This morning, he was called in by Stallings to minister to a recalcitrant disk drive—and found that a quick punch in the side got the machine going again.

This is, according to O'Conne, not the first time this treatment has worked. He recalled one new machine that was in for review and simply refused to boot. Mike found that the only way to get the computer started was to give it a not-too-gentle tap after hitting the On switch. When he called the manufacturer to explain exactly how he was turning on the machine, the guy at the other end of the line said happily, "Well, then, there's no problem anymore, is there?"

"That's not the way it works," O'Conne told him, and hung up. The computer, needless to say, was not a success.

Generally, it is unusual for Mike to resort to brute force in dealing with machinery. In fact, he is famous at *PC* for his ability to check software, fix hardware, phone manufacturers, and in general play handyman to the *PC* editorial department. You might even say that he is *PC*'s resident expert system.

Expert Systems

Which brings me, none too subtly, to the subject of *PC*'s cover story for this issue. Expert systems are software packages that experts in specific fields can

"program" with their knowledge. By distilling their expertise into a set of laws and entering them into the system, experts produce application programs that

can help nonexperts solve problems in the experts' fields by responding to the programs' queries.

Associate editor Lisa Kleinman, who

oversaw this issue's feature section, was frantically trying to get the last few pieces to the copy editors while I was writing this column. However, I managed to tackle her long enough for her to gasp, "To review the expert-systems software, we decided that best way to

Expert systems are software packages that experts in specific fields can "program" with their knowledge.

evaluate each package was to let it do its stuff." She broke the armlock and dashed away again, just pausing long enough to add, "We also thought it would give the art department something to work with."

Expert Applications?

In fact, it also gave the editorial department something to giggle at. Our reviewers, not known for stodginess, came up with some pretty strange themes to work into the expert systems they reviewed. Jared Taylor, for example, took George Orwell's *1984* as his inspiration for a political decision-making model he developed with *Lightyear*. Frank Derfler used *Expert-Ease* to demystify long-distance phone service. And Robin Webster, revealing his taste for high-class literature, programmed *M.I.* to explain how to tell whether an unidentified flying object is a bird, a plane, or Superman.

The potential for using these expert systems is almost endless. We should really try to set up an O'Connell expert system that could answer questions about microcomputer breakdowns. For example, when asked, "What do you do when the B: drive doesn't function?" the program might answer, "Give it a good whack on the side."

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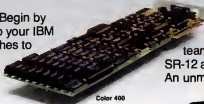
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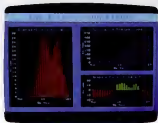
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(Source: "Ergonomic Principles in Office Automation" Pub. 1983 by E.L.S. AB, Sweden.)

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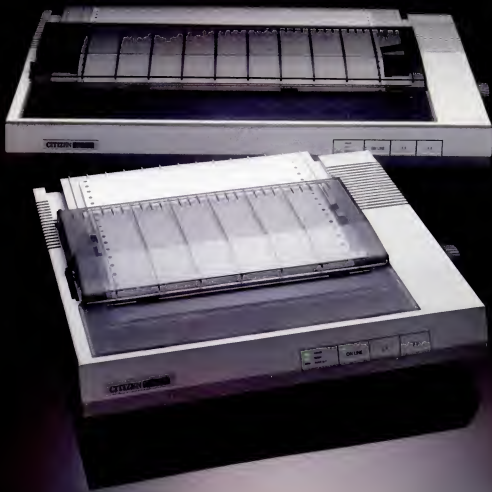
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IBM News

FROM THE EDITORS OF PC

April 16, 1985

Gunfight at AT Corral

Compatible makers square off to make AT clones.

BY CHARLES BERMANT AND VIRGINIA DUDEK

NEW YORK—Computer makers are scrambling to get an IBM PC AT lookalike to market while a shortage of the new machine still exists. But even if IBM meets its AT production quota soon, a dozen different desktops based on the powerful 80286 chip may be available by year's end.

The race to be first with an AT clone seems to have an upset winner. Kaypro, which entered the MS-DOS market less than 4 months ago, is now showing its 286i on a limited basis, and company officials say they hope to produce 2,000 machines every month beginning in April of this year.

Kaypro vice president David Kay said that the 286i, with a base price of \$4,550, is comparable to the \$6,000 version of the AT. As with the rest of Kaypro's line, the machine is bundled with several software packages. A fixed disk, which would add \$700 to \$800 to the cost, is not available at this time.

No shortages of the unenhanced AT, which the 286i resembles, have been reported. Kaypro, however, will use price and software bundling as selling points.

Microsoft vice president Jim Harris says the rush to clone the AT will not rival the replication of the PC three years ago. "The development of AT compatibles will be slower because people

are still trying to figure out how the multi-user aspect fits in," he says.

However, Otis Bradley, an analyst at Baltimore-based brokerage firm Alex Brown and Sons, says the survivors in the compatible marketplace must include an AT in their lines. "Anybody who's left will have to make an AT compatible," he says. "The AT stands for a large part of the industry. I expect the major companies now have them."

Yet timing isn't everything. "I don't see that it's any easier to do an AT than a PC compatible," says industry observer and analyst Esther Dyson, president of EDventure Holdings, Inc., in New York. "Certainly there's a shortage of ATs right now, but it won't last. I'd say entrepreneurs should try some

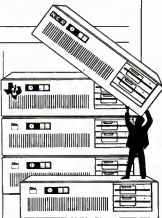
other business."

Dyson suggests the AT market may not be as big as some think and that market niches in AT software may be easier to find. "It's a competitive market where the smaller companies have a hard time. The innocent bystander will probably get hurt."

Forewarned Is Forearmed

Much like cigarette smoking, however, the selling of IBM compatibles is an addiction that continues in spite of the warnings and obvious hazards.

Motherboard manufacturer Faraday Electronics Inc., of Palo Alto, Calif., along with Phoenix Software Associates, of Norwood, Mass., started the AT ball rolling months ago. Faraday released an AT motherboard February 22 but had pre-



viously made the board's blueprints available to other manufacturers. Phoenix is licensing AT-compatible ROM BIOS software to at least seven PC-compatible manufacturers, according to company vice

(continued on page 35)

Controlling the Price of Success

BY VIRGINIA DUDEK

OREM, Utah—W.C. "Pete" Peterson is on the horns of the proverbial dilemma. He's the executive vice president of Satellite Software International (SSI) located here. The compa-

ny's WordPerfect word processing program is selling well, and that, he knows, is good. It is also selling cheaply from some mail-order houses, and that, he is afraid, may not be so good for

the long-term distribution of his company's mainstay product.

Consumers may well rejoice in software marked hundreds of dollars below suggested list prices, but Peterson worries that this boon may become a bane to the retail dealer distribution network that Satellite has used and profited from in the past.

"The distributor's margins are much thinner this year than last year," says Peterson. "There's free overnight deliv-

(continued on next page)

Success (continued)

ery, negotiation for co-op money with advertisers, and different schemes to compete."

Peterson is concerned with the policy vendors use to discount the software they sell to distributors and retailers. SSI gives a 50 percent discount off its suggested list price of \$495 to dealers and a 65 percent discount to distributors on purchases of *WordPerfect*. A distributor might then sell it for a discount of 55 percent to a mail-order house, up from the typical 40 to 45 percent discounts of a year ago. The mail-order house can then sell the product for anywhere from \$229 to \$249. Both the distributor and the mail-order house are earning slim profits of \$25 to \$30, but both have to compete with cut-rate prices from other mail-order houses and distributors.

In the meantime, the retailer, with a smaller discount and a greater overhead, cannot realistically be expected to compete with the mail-order house on price.

"As the spread between retail list price and mail order gets bigger," says Peterson, "mail-order sales increase. The mail-order price is so low that it's embarrassing to us. We have no control over it."

Risky Business

Peterson is concerned that as mail-order sales increase, dealers' retail sales will decrease. While most customers want a good price, many inexperienced users require the kind of support traditionally offered by dealers. "Our primary channel of distribution is retail," says Peterson. "We do not want discount sales to dominate, but with price pressure at the distributor level, they might."

Peterson says SSI is seeking legal counsel on how to avoid antitrust litigation while at the same time exerting some control over who can sell *WordPerfect* and at what price. "It's hard to keep *WordPerfect* out of mail-order sales contractually," says Peterson. "We can suggest distributors sell it at a certain price, but we can't force them to." SSI is considering a clause in the selling contract

that says the contract can be canceled without cause. "We can do that as long as we don't say it's canceled because of price."

Peterson thinks that the concentration of software sales has shifted. "A year ago, 40 percent of software was sold in specialty stores and 30 percent by mail order. Now that's reversed." But Lorraine Mecca, chief executive officer of Micro D, a major national distributor located in Fountain Valley, Calif., disagrees.

"My numbers say mail-order accounts for 10 percent of sales. It is an important part of sales, yes, but a big part, no."

Micro D recently changed its price structure. Volume discounts are no longer in effect, except for very large orders. That means the dealer who orders three copies of a program gets the same discount as the mail-order house that orders 50.

"We offer a better price than the vendor," says Mecca, noting that Micro D cuts 12 percent off the price to dealers. "We also offer faster service and financing."

No Violins, Please

But not everyone feels the

dealer gets the short end of the wishbone. "We sell a product that retails for \$500 to dealers at \$300," says Mike Carrau, operations manager of Softsource, a distributor in Bedford, Mass. "They make \$200, I make \$40. Dealers make a killing. They should be the last to go down because the markup at their end is phenomenal."

Carrau acknowledges the competitive stance of distributors like Micro D but as far as Softsource is concerned, "I have to make sure we're here next year. We're a full-service distributor with a technical support staff."

"The dealer makes a face-to-face sale, with the support and recommendation that the mail-order house doesn't have. There are two types of software customers, like those who buy from a discount broker and those who buy from E.F. Hutton. I think there is more order-taking on the dealer's part than selling. If customers want an obscure product, dealers order it. But if they're out of *dBASE III*, they should try to sell something else."

From a dealer's point of view, the competition for software sales is tough and getting

tougher. "Consumers aren't dumb," says John Williams, a partner at Software Specialists, a Washington, D.C., retailer. "It's basically turning into the stereo business, a commodity business, like consumer electronics."

"Who is buying enough products to support the retailer?" asks Williams. "Some thought business software buyers were not as price-sensitive and would be the logical customers for retailers. But big business is starting to develop its own in-house support. I do believe there is a fine line, and those who sell by support had better be sure they support the product."

Fair Is Fair

Many see the heavy discounting of software as a trend that results from fierce competition for software sales.

"Software prices are undergoing a lot of compression," says Micro D's Mecca. "The products are not worth \$800, and the retailer gives up margins because the consumer refuses to pay. The only people not yet moving on price are the manufacturers."

(continued on next page)

PC Economics: Rivalry Means Service

IBM's reorganization of its marketing and distribution channels (see "Doing the PC Shuffle," Volume 4 Number 6, page 35) comes at a time when retailers have barely finished reacting to the increased competition from IBM Product Centers and the company's National Accounts Division. According to industry analysts and retailers, dealers will be stepping up education, technical support, and repair services for their clients.

"In the future, dealers are going to have to emphasize service," noted industry observer Maureen Fleming of International Resource Development. "Dealers will have to sell service instead of just selling a computer to a customer and then kicking them out the door."

Fleming predicts that a shakeout among retailers will result in fewer dealers. At the same time, dealers will fall into one of two categories: value-added (or service-oriented) stores, and stores that emphasize price alone.

Experienced users resent retailers that won't fix their computers, she explained. "A dealer who knows how to fix all these things is going to make out. We're going to start seeing more breakdowns. If you're trying to run a business, you can't deal with interruptions."

According to ComputerLand's director of communications Chad Hill, "We see more and more emphasis by both large and small businesses on strong after-sale support."

Accordingly, ComputerLand is helping its franchisees set up Learning Centers, off-site training facilities available to its clients.

The increased competition from IBM's National Accounts Division for Fortune 1000 accounts seems to have had little effect on ComputerLand's sales. Hill maintained that corporate sales have been steady. Between 40 and 50 percent of ComputerLand sales are to businesses, he noted.

A New York City retailer agreed, adding that "In early 1984, IBM was probably one of our toughest competitors (among Fortune 1000 accounts). Now, the other dealers are probably tougher competition. IBM has a lot of corporate advantages, but they also have a lot of disadvantages. In a typical corporate package, IBM logo products make up only 60 to 65 percent of the total." —By Gus Venditto

New Kaypro Portable



Kaypro Corporation, first in line with an AT-compatible machine, is also breaking the portable computer price barrier by offering a new MS-DOS, 8088-based Data General/One clone priced at less than \$2,000.

The Kaypro 2000 is stuffed with 256K RAM, expandable to 640K. It comes bundled with MS-DOS, GW-BASIC, "word processing and a business application package," according to the company.

The 11-pound machine features a detachable keyboard

with function and cursor keys. Its display is an 80-character-by-25-line adjustable LCD screen with a graphics resolution of 640 by 200 pixels.

Floppy disk drives are 3.5-inch Sony Standards with a total capacity of 720K. The 2000 also boasts an RS-232 serial port for input/output, with an optional 300/1200 internal baud modem. The company says that the machine can be run off batteries for up to 4 hours of normal disk access. The 2000 carries a suggested list price of \$1,995. ■

Success (continued)

Mecca notes that the older versions of software products decrease in price, but newer versions do not. "For the last 10 years hardware has gotten less expensive for more features. Software has to live with the same reality as hardware."

But there is more to software than the cost of the disk. "I hear the same comments about high prices over and over," says Peter Norton, author of the Norton Utilities. "It's sort of true, but so what? No one knows the proper price for software. The actual manufacturing cost is irrelevant. The intangible content, the research and development, makes up the real cost."

Norton doubts that the existence of low-cost software products, such as several \$100 word processors now available, will have an immediate effect on software pricing.

"I agree that prices are probably going downwards," he says. "The appearance of the low-cost word processor, like anything else, puts on pressure. I don't think we will see a sudden significant drop, but rather a slow downward migration of prices."

Williams of Software Specialists says that mass marketing of computer products is inevitable and that software prices will eventually fall. "It makes sense to sell inexpensive products and support the distribution channel," he says. "When the price comes down, mail-order software sales will be less viable." ■

Gunfight (continued from page 33)

president Richard Levandov. "IBM is good at introducing new products that cannibalize other products," says Faraday's Ron Mazza. "But the first manufacturer to come out with a good AT product will be around for a while."

While Kaypro should be the first to get to market, the trifecta result isn't yet clear; the rest of the field is still in the stretch. Rumor and unsubstantiated fact run rampant. And many vendors' public relations representatives are as IBM-compatible as their products, coming up with such Blue-ish statements as, "It is not our policy to comment about products under development."

Peanut Gallery

Corona president Daniel Carter, while keeping mum about his company's plans, says "anyone that wants to retain a reputation as a single-user compatible manufacturer will have to introduce an AT. If a vendor hasn't moved toward a broader product line, it'll have a tough year."

"IBM has set a new interface standard," says NCR's Vernon W. Yates. "Software manufacturers will need to develop a compatible type of interface. The message is to be AT compatible."

But Yates is similarly evasive about specifics, saying "NCR has acknowledged its intent to have a family of products, a variety to serve the market, sometime in 1985." ■

"Every company has to at least look at a 80286-based machine," says Tandy chairman and CEO John V. Rouch. "Although we certainly don't have a machine planned at the present time, our product development people are looking at half a dozen machines. But who knows what will get to market?"

Compaq, thought to be the best-positioned compatible maker, may prove to be the exception. While the company has promised six new products this year, it is apparently not one of those racing to be one of the first AT merchants.

"I can't see where there will be an abrupt changeover to 80286-based machines," says company president Rod Canon. "I disagree with the mentality that you have to clone anything to succeed. Few AT clones will be sold, though they'll sell some while there's a shortage."

"We are watching what people are using ATs for and are listening to what our dealers say. It's what we've always done. We will respond if needed."

New Kid in Town

The battle for a slice of the AT pie isn't restricted to the better-known players. Tomcat Computer Corporation of Los Angeles announced its own AT compatible, the 3200 AT, at the Fall COMDEX. Tomcat had a prototype AT in September and is now showing off a preproduction model.

"We were able to quickly come up with an AT compati-

ble," says company president Ken Inouye. Tomcat, which has sold PC and XT compatibles in the Asian and European markets for the past 2 to 3 years, is new to the United States.

Inouye said Tomcat initially planned to market a AT-compatible machine in a smaller format before opting for an IBM lookalike. And he wants to sell the machines for 25 percent less than the AT's price. "Either you spend a lot of money on advertising or your price is low and people come to you. If it runs like the IBM, there's no question people will buy it."

Inouye says April is the tentative target for shipping the machine. But even if the 3200 AT outperforms the competition, Tomcat will have to peddle twice as hard. "Shelf space is now at a premium," says Faraday's Mazza. "Retailers will only go with brand names. And value doesn't come only from price comparison; something different must be offered."

Handoff

"A lot of people were planning to go to 80286 technology anyway," says Phoenix's Levandov. "Most companies now realize that in order to be in the computer business at all, they will need a strong product line on the AT-workstation level. No one's going to make the mistake of being better, faster, and more efficient without being AT compatible."

That the AT does not run all PC software raises the possibility that some companies may market a more PC-compatible AT clone. Levandov says he did not attempt dual compatibility because the code can be easily revised to accommodate the higher software standard. The 286i is AT—and not PC—compatible.

"We don't expect to sell to people who don't have experience with computers," says Kay of the 286i's future. "We'll sell to those who already have PCs and Kaypros. And I hope software developers utilize this new power. It's not there just to run *WordStar* or *1-2-3* a little faster. This technology will lead to the next area of growth." ■

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CIRCLE 437 ON READER SERVICE CARD

News In Brief

Fighting Foreign Pirates . . . Senator Frank Lautenberg (D-NJ) has introduced legislation designed to maintain international copyright protection of software. According to ADAPSO (Association of Data Processing Service Organizations), which endorses the legislation, the bill is a response to proposals in Japan, Brazil, and other nations that would significantly weaken or abandon software copyright protection. The Japanese Ministry of International Trade, for example, is considering legislation that would abandon copyright protection for software.

Lautenberg's bill says that if a nation establishes less than 25 years of copyright protection for software or lessens protection in some other way, the software developed in that foreign nation would have no copyright protection in the United States. The bill also states that if a foreign nation provides copyright protection for software of more than 25 years, then the United States will recognize that same duration of protection for software developed in that nation.



Senator Frank Lautenberg (D-NJ)

The Sierra Club . . . While IBM's personal computer line has grabbed the most attention of late, its mainframes still account for the bulk of its business. And mainframes are even more in the spotlight now that IBM has introduced its new top-of-the-line **Sierra mainframes**, officially known as the **3090 series**.

This November, the first Sierra machine will appear—the 3090/Model 200, base price \$5 million, with the ability to process 28 million instructions per second (mips). A year and a half later, in 1987's second quarter, IBM promises the 3090/Model 400. With its four linked processors, it should be able to work at a rate of over 40 mips.

IBM also announced its plans to offer UNIX System V for some of its mainframe computers. In light of Microsoft's recent decision to change its XENIX operating system to match AT&T's System V standards rather than continue its System III-compatible XENIX, it looks like IBM's mainframes and micros are getting closer together, bit-by-bit.

Board and Blue . . . A new IBM PC AT-compatible color graphics and printer adapter board is now available from **Bronson Electronics Corp.** The **Innovation CGP** is a single-board adapter with a parallel printer port, an IBM light-pen connector, and socketed



ROM and RAM for different character fonts and expansion.

Innovation CGP costs \$244 and works with color/graphics software designed for IBM PCs, XTs, ATs, and compatibles.

Bronson Electronics Corp. is located at 12700 Nicollet Ave. South, Burnsville, MN 55337 (612) 894-6466.

Making Book on Software . . . At first glance, Synapse's electronic novels seem like a blend of adventure games and prose-synthesis programs. But company president **Jon Loveless** says that the game-playing public "has had its fill of cursor-shoot-dot" and the new format will soon take computer users into uncharted educational and recreational waters.

Mindwheel, a science-fiction fantasy, is the first such disk/book combination. Eight others are in the works—mostly science fiction and adventure with mystery and horror thrown in. There are no plans for pornographic electronic novels, but, according to Loveless, "it's not out of the question. We have to be conservative until it's accepted as true literature."

Synapse, which manufactures **Relax**, a stress-reduction package as well as several other game programs, was recently acquired by **Broderbund**. This merger, says Loveless, has formed the country's largest home-market software company.

PC Fix-it . . . After years of telling would-be auto mechanics what to do when their vehicles develop coughs and sputters, **Chilton Book Company** of Radnor, Penn., has entered the world of chips and DIP switches. First in a new series of computer repair manuals is **How to Repair and Maintain Your IBM PC**.

The company claims that Gene B. Williams's book "takes the mystery and guesswork out of servicing the IBM Personal Computer." It might also want to point out that home repair takes the warranty out of the PC, as well. Regardless, for those with a brave heart and a lust for tinkering with the insides of their PCs, the book, which costs \$12.95, is available in bookstores nationwide or can be ordered from the company directly.



Does your PC overheat in traffic? Is the zip gone out of your disk driving? Well, there's a computer version of Mr. Goodwrench just waiting to help you cure your woes.

Lucid Moments . . . LUCID Software Corp. has introduced a new, high-level programming language designed for business applications. The **LUCID** language is based on C, but does not have any variable-type declarations. LUCID has 118 built-in functions enabling it to perform tasks such as sequential and random file I/O, string manipulation, data conversion, and mathematical functions. It also has a built-in database manager and screen forms manager.

LUCID runs under MS-DOS, PC/IX, UNIX, and the XENIX operating systems. It can directly read data from both **dBASE II** and **dBASE III** and can easily access and interchange data from **I-2-3**, **Symphony**, and **Framework**.

The MS-DOS and PC/IX versions of LUCID cost \$295, and the IBM XENIX version for the IBM PC AT costs \$395. The UNIX version is customized, so the price will vary.

More information on LUCID is available from LUCID Software Corp., 3080 Valmont Rd., Boulder, CO 80301 (303) 442-4981.

—compiled by Jane Mintzer, with Charles Bermant

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OYSAN.	10 cm SS-80 (Agaric HRP)	\$ 46	
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MAXELL.	10 cm SS-80 (1 MAC)	\$ 60	
	10 cm SS-80 MISO (HMA)	\$ 73	
	10 cm SS-80 H-Dens (HMA AT)	\$ 77	
MEMOREX.	10 cm SS-80 (1 MAC)	\$ 62	
	10 cm SS-80 H-Dens (HMA AT)	\$ 84	
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AX300—477	\$ 380	CALL
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P4100—180 cps, 126 col.	\$ 845	CALL
P880—Color Printer, 160 cps	\$ 595	CALL
Q31500—200 & 57 cps	\$135	CALL
Force-Feed Fax 121500	\$ 70	CALL

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90ps - 80 cps	80 cps	\$ 299
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83A - 132 cps	120 cps	\$ 749
84 - 138 cps	200 cps	\$ 899
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QUADRAM	Quadrant	\$ 895
STAR MAC,	Germany	\$ 499
120cps, 10"		\$ 549

YOMBA , Prop. spacing & 40-meg graphics	\$ 200	\$ 475
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1240—144 (280 DSI) & 54 (280 DSI)	\$ 950	\$ 780
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TTA, TTAgres. portable/handheld-40cps	\$ 229	\$ 129
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TTA , 1014—13 cps, auto/rev p & r 2p	\$ 450	\$ 381
1116—same as 1014 w/TA6 2c & prog	\$ 580	\$ 430

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Color 500 Comp/VCN RGB/Audio	\$ 525	\$ 399
Color 600 w/ Res. RGB/Audio	\$ 599	\$ 499
Color 700 Ultra w/ Res. RGB	\$ 749	\$ 549
Color 710	\$ 799	\$ 599
Sound 400 Cass	\$ 129	\$ 99

200G 12" Green	\$ 179	\$ 121
200G 12" Amber	\$ 199	\$ 141
210A 12" Amber (IBM)	\$ 239	\$ 159
PRINCETON, HX 12" In Res. RGB	\$ 299	\$ 189
210A 12" In Res. RGB	\$ 299	\$ 189

SA-12 16 in. AGS	\$ 750	\$ 599
Size Counter for SA-12	\$ 240	\$ 179
WAS 12" Antler (nonchrome)	\$ 240	\$ 199
QUADRAM , Antlerchrome 12" Antler	\$ 250	\$ 199
Quadrome 12" AGS Color	\$ 895	\$ 499

Quadrant 12" RGB-Cool	\$ 895	\$ 495
Quadrant 9" 14" RGB-Cool	\$ 850	\$ 450
Quadrant 17" 16:10 12" e-cable 16 Pin	\$1950	\$1590
ZENITH, ZVM12 12" Active	\$ 150	\$ 90
ZVM12 12" Open	\$ 180	\$ 90

266M123 12" Screen	\$ 149	\$ 99
266M124 12" Ambient	\$ 209	\$ 149
266M125 12" Case	\$ 599	\$ 499

MODEMS

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HAYES, Jack (Lateral Motion) (2001)	\$ 800	\$ 800
SmartMedia (2000) (IBM)	\$ 500	\$ 400
Smartcom II Software (IBM)	\$ 140	\$ 90
Stack Chromograph (RS 232)	\$ 240	\$ 190
Sumner, C. (Lateral Motion) (2001)	\$ 240	\$ 240

Stack SmartModem 3000 (RJ-22C)	\$ 299	\$ 219
SmartModem 1200 (AP)	\$ 899	\$ 499
MicroModem II w/ SmartCable (AP)	\$ 329	\$ 239
PROMETHEUS, ProModem 1200S (RJ)	\$ 399	\$ 299
ProModem 1200S (RJ)	\$ 399	\$ 299

FROM:com (200 items)	\$ 549	\$ 42
QUADRAM , Quadmodem, Internal (384)	\$ 505	\$ 42
Quadmodem, External (IBM)	\$ 605	\$ 49
VENTEL , PC Mail Card (IBM)	\$ 549	\$ 38
1000 Blue, External (IBM)	\$ 499	\$ 43

1200 Plus External (16M)	\$ 499	\$ 449
PC1200 Internal (16M)	\$ 499	\$ 379

ACCESSORIES

CURTIS , Diamond 6 outlets, finished	\$ 50	\$ 2
Emerald 8 outlets, 8 cord	\$ 80	\$ 3
Ruby 8 outlets, 8 cord, like	\$ 90	\$ 5
Sapphire 3 outlets, w/liner	\$ 80	\$ 4

NE THERMAL, Weyman 4 outlet white surge	\$ 70	\$ 3
PERFECT DATA, Head Cleaning Kit	\$ 15	\$ 1

Lotus Lowers the Boom

BY CHARLES BERMANT

BAKERSFIELD, Calif.—A small computer retailer is singing sour notes about his treatment by Lotus Development Corporation, which summarily revoked his right to sell the company's software products.

Brett V. Myers, president of Financial Data Services, Inc., was notified of the action in a letter January 9 and says he was given no opportunity for redress. He says he did not violate any part of the company's complex dealer agreement, which forbids mail-order sales and national advertising.

Lotus Motion

Representatives of Lotus, the manufacturer of *1-2-3* and *Symphony*, declined to comment. Myers, however, says he received a call from a Lotus representative shortly after *PC Magazine's* inquiry. No reason for the termination was given to him, he says, beyond the term "restructuring."

In a January 21 letter to Lotus, Myers stated, "It's obvious that you feel that small, independent dealerships such as ours do not merit your attention. However, the funds we have put into our Lotus program represent a significant investment for our company. Therefore, having our dealership pulled out from under us without good cause is particularly distasteful."

The store in question is a retail computer outlet with 1,500 square feet of selling space and five employees. Myers had initially applied to sell Lotus software through Softsel in 1983, was cut off (again, with no reason given), and had reapplied. After a delay, he was reinstated as a dealer last summer. Myers said that his store is one of nine selling Lotus products in this community of 100,000.

Looking for Answers

"We have now lost a lot on employee training needed to support these products, and we've expended a lot of time and money on this. But we

weren't given any explanation for Lotus's action," he says of the Cambridge, Mass., company. "For all we know, one of our competitors called Lotus and lied about us."

Myers says that he had, in fact, convinced one local financial institution using unauthorized versions of *1-2-3* to "come clean" and buy legitimate copies. He says that his store plans to enter into a franchise agreement with a larger chain authorized to sell *1-2-3*, "so the issue will soon be moot."

But David Wagman, chair-

man of Softsel, a major Lotus distributor, says that this isn't a unique case. Lotus has always reserved the right to terminate dealer agreements without giving reasons. Wagman speculates that Lotus may take such action when a dealer doesn't follow the stated rules, and that it may also consider the size and financial strength of the dealer.

"It's like *The Naked City*," says Wagman. "There are a lot of these stories out there. But if Lotus doesn't want to sell to a dealer anymore, we have Lotus contact that dealer themselves. We let Lotus be the bad guy." ■



Brett V. Myers

PCs Rated Number One

A survey of American business confirms what many have already assumed.

SAN JOSE, Calif.—A survey recently released by *Fortune Magazine* reports something that most people have long assumed: When it comes to choosing personal computers in American businesses, IBM gallops across the finish line while the rest of the field is just entering the far turn. The reasons for IBM's success are numerous and varied, but it wouldn't be too far off the mark to say that IBM is the champ simply because it's IBM.

The *Fortune* survey polled 2,800 subscribers consisting of top management, information-systems people, and professionals working in other areas of their companies. Over three-quarters of all respondents said their companies used personal computers, and IBM PCs were used in 56 percent of these companies. Apples placed far back with 16 percent, and no other brand tallied more than 5 percent.

Brand Recognition

Not surprisingly, IBM's brand-recognition factor scored

a high 82 percent among the businesspeople who responded to the poll. Apple received a 74 percent recognition score, followed by Commodore (60 percent), Tandy/Radio Shack (59 percent), Hewlett-Packard (58 percent), Texas Instruments (56 percent), and Wang (54 percent). No other companies were recognized by over half of the respondents, including such industry mainstays as Digital Equipment Corporation, Compaq, Data General, NEC, and TeleVideo.

The survey attempted to determine the chief purchasing criteria used by businesses. Eighty-two percent cited the variety of software available for a particular brand of personal computer; 81 percent chose a system because of its reliability. The manufacturer's overall reputation and the quality of its service and support were factors for over three-quarters of the respondents.

Respondents also cited ease of learning how to use a system (67 percent), price (60 percent), and compatibility with other

computers in the company (55 percent) as other considerations. A surprisingly low 29 percent listed dealer recommendations as a factor.

A Useful Item

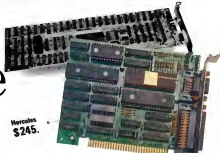
The uses for personal computers in American business pretty much correspond to the software best-seller lists. Seventy-nine percent of the respondents use personal computers for financial analysis, with 60 percent also using it for accounting. Word processing was right behind with a 59 percent response, and general record-keeping scored 58 percent.

Other functions fell below the 50 percent level. In descending order, they were: sales reporting, tracking, and forecasting (45 percent), communications (32 percent), graphics (31 percent), personal recordkeeping (25 percent), engineering and scientific analysis (21 percent), payroll/personnel (19 percent), instruction/education (11 percent), and games (9 percent).

The survey was released at a forum conducted here in late January. Copies of the results are available for \$25 from *Fortune*. To obtain one, write to "Personal Computers in Business," Room 1771B, Time-Life Building, Rockefeller Center, New York, NY 10020.

—By Don Kennedy

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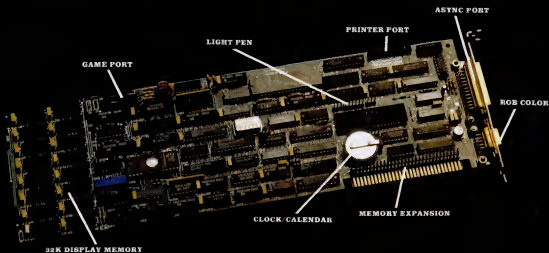
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PC-Communiqués

EDITED BY JAMES LANGDELL

Tetradecahedrons To the Rescue!

What would you do without crib sheets? You'd dig through thick manuals every time you forgot a software command, that's what. Instead, some of you no doubt spend your time looking through thick stacks of paper on—or under—your desks, trying to find lost crib sheets.

While engaged in such a hunt, do you ever say to yourself, "Right now I sure could use a three-dimensional 14-sided tetradecahedron with a set of easy-to-read dBASE II commands printed on it"? If so, then stop talking to yourself, crawl out from under your desk, and go buy a Glimpex—a new accessory created by Hugh Kent of Foggware that fits this description.

A Glimpex keeps your dBASE II facts straight, but not flat. They rise, instead, in solid form, thanks to a rubber band

that adds muscle to the insides of this sturdy paper structure. The Glimpex stands out against the clutter on a busy desk, but you also can squash it down harmlessly into a flat star that you can slip inside a standard software manual.

The first Glimpex is titled "Using dBASE II." Other versions with commands for popular integrated packages and word processors will be released soon. List price for each is \$9.95; add \$2 per order for handling if ordering directly from Foggware, 4931 Van Epps Rd., Cleveland, OH 44131, (216) 749-0942.

The Glimpex is informative and decorative, but we think its beauty was overstated by its inventor. Kent predicted that "many Glimpex owners will enjoy collecting sets of Glimpex for the office in the same way they collect Hummels or brass figurines for their homes." ■

Any Color, As Long As It's Green

A new device called the GreenSwitch makes your PC's color display look like a monochrome monitor. But why would anyone want to go back to a green-on-white screen? Is there really a market of nostalgic users who long to relive the primitive computing days of yesteryear?

The GreenSwitch's creator, Future Products (3864 Scamman Court, Fremont, CA 94538), makes a serious case for its regressive accessory. Some users find that green-on-black screens are less harsh on their eyes than the typical white-on-black color-screen format for spreadsheet or word processing programs.

Although many programs allow you to select screen color—and others can be



"patched" to do so (PC's User-to-User section often contains examples)—some programs defeat any attempt to change their colors. The \$49.95 GreenSwitch, which connects between the color monitor and computer, gives you a simple way to bypass the software and go for the green.

The GreenSwitch's knob offers four settings. The first allows normal colors; the second produces a bright green foreground; the third uses dark green in the foreground with bright green highlighting; and the last displays everything in dark green.

The GreenSwitch works fine when all the relevant material on the screen was black-and-white to begin with. Text

doesn't look as clear as it would on a true monochrome system, but that's due to the mono monitor's higher resolution, better-formed characters, and darker background. The GreenSwitch can get you into trouble, however, with programs using multiple colors. GreenSwitch's pseudo-monochrome modes can fade or even entirely lose contents that had appeared in certain colors.

If your eyes need more greens in their diet, this well-constructed switch will serve them nicely. But we expect a typical user will be no more eager to handicap a color monitor with a GreenSwitch as convert a 20-megabyte hard disk back into a 128K floppy drive—or shoot himself in the foot. ■

High-Tech Flasher—The Next Smile Button?

What is it?

The eyes (microlights?) blink—red—green—red—green. The inch-square face is black with gold paint, apparently representing a microprocessor chip. In fact it looks more like a totem pole face. And, indeed some surveyors of the chip found the back side with soldering and wiring more amusing, certainly more suitable for wearing to a punk concert at the Ritz in New York City.

To really confound things, there's wire to turn the gizmo into—you guessed it—an ear-ring. There's also a tie tack, but one has to wonder why. This

\$4.95 trinket is not the sort businessmen would pin on their suits.

"In a cold world of bytes and bits, everyone needs a little friend chip," counsels the brochure/manual for this "Computer Friend Chip." The brochure is laced with advice on care, favorite recreational activities, and features of this weird chip, which has only about 5 percent more personality than a Pet Rock. (After all, it's electronic—see the batteries.)

This pet chip is obviously well loved by its inventor, Lawrence P. Lin, whom the press release says made enough money



in the printing business to launch an expensive—people sitting on billboards on Sunset Boulevard—advertising campaign.

So, what is this "humorous visual symbol of the technology

age that takes some of the mystery out of the computer chip?"

Why, it's a "Winkie". That's it! That's why I don't warm to "Winkie"; I've been trying to avoid "Winkie" all my life. —Connie Winkler



Look, PC. A Game for Us!

Have you, like PC user Steven Stilwell, been frustrated playing Trivial Pursuit? Do you share his complaint? "I waited and waited for a Trivial Pursuit question about the IBM PC."

While Stilwell was waiting, he created a computer game of his own, called *PC-Trivia*. It's not merely IBM PC compatible—all its questions are about the IBM PC.

PC-Trivia's on-screen game board has spaces labeled with four categories: Hardware, Software, People, and Misc. When you land on a space, you press Enter and try to answer the question that appears. You might be asked one of the following:

- **SOFTWARE:** "What was the original name for Ashton-Tate's dBASE II program?"
- **HARDWARE:** "How much power can the speaker on the PC handle?"
- **PEOPLE:** "Who plays Charlie Chaplin's Little Tramp for IBM?"

• **MISC.:** "What was the cover date on the first issue of *PC Magazine*?"

The answers are: *Vulcan*, 1/2 watt, Billy Scudder, and February/March 1982.

PC-Trivia can be played on a color or monochrome system and costs \$29 from Stilwell Software Products, 16403 N. 43rd Dr., Glendale, AZ 85306, (602) 978-4678.

Why isn't there a trivia game based exclusively on *PC Magazine*? We can imagine some of the questions:

- "How many printers were reviewed in *PC*, Volume 3 Number 23?" (120, according to the cover).
- "What was controversial about the cover of Volume 2 Number 3?" (the model's cleavage).

We could be aces at that game, if anyone else was willing to play. But our potential playmates will probably be too busy trying to finish reading or creating each issue of *PC*.

What's Saucy for The Goose Is Verse for the Hacker

Many books aim to teach young children about computers, but *Mother Goose Your Computer* (Sybex, Berkeley, Calif., \$12.95) isn't one of them. A subtitle bills it as *A Grownup's Garden of Silicon Satire*. As that sobriquet suggests, the authors (Paul and Anna Belle Panish) and illustrator (Terry Small) use the manners of children's literature (*Mother Goose* rhyme, grandfather tale, and alphabet book) to present adult subject matter—R-rated ribaldry as well as mature technology.

In attempting to combine these two, the book falters. It would have been more amusing for young and old if its creators had stuck to updating *Mother Goose* in light of only one modern revolution: the electronic rather than the sexual. The verses and illustrations based purely on computers are funnier than those that go for cheap bathroom humor.

Like the originals, the best rhymes capture folk wisdom about computers in a form that's delightful to repeat aloud:

*Tom, Tom, the burglar's son,
Stole a machine and away he ran.*



The job was neat, but Tom got beat:

By the time he got home it was obsolete.

But on another page, one of the nicest artistic touches is wasted on a rhyme that classes writers of computer manuals along with bathroom graffiti scrawlers. On the outhouse door in this unfortunately graphic illustration, there's an elaborate metal hinge, a fine piece of old-world craft that, on second glance, turns out to be in the shape of a flow chart.

Even as we enjoyed the best parts of this uneven book, we suspected that *Mother Goose Your Computer*'s creators are capable of an effort that would lead children to delight in computers. And we bet that nursery book would attract adult computer users, who would appreciate the parts—as in Lewis Carroll's works—that are presumably beyond children's ken. But the creators missed the best of both of these worlds and instead mired themselves in adolescent sleaze.

A Rack and Roll Robot?



Is this a mate for Robby the Robot, salvaged from an accident with an upright vacuum cleaner, a shopping cart, and an IBM PC? No, it's the *PC Caddy*, from Omnium Corporation.

The basic self-contained portable workstation costs \$299; a printer stand accessory (seen here at the top of the heap) costs an additional \$79. If you're interested in a caddy for your computer, contact Omnium at 203 North Second St., Stillwater, MN 55082, (612) 403-2060.

Baud Double: The Hayes 2400

BY JOHN DICKINSON AND M. DAVID STONE

Editor's Note:

"HHeellloo...DDaavvviid..."

"Turn your echo off, John."

And so it was that, at long last, reviewers John Dickinson and M. David Stone communicated using the new Hayes Smartmodem 2400. A pair of the 2400's arrived for review, with the obvious implication that with only one modem operating at 2400 baud, you'd never be able to use it to communicate with anyone else at such high speeds. However, we took it one step further.

With two modems, we decided to get two opinions of the newest product from Hayes. M. David Stone is the author of Getting On-Line and writes many of PC's Telecommunications columns. On the other hand, John Dickinson, who may possess expertise in assembly language programming and printers, has never laid claim to being all that adept in the sometimes-frustrating world of computer communications. In fact, he says there are only two things in the world he hates—bysynch and asynch.

Their report follows:

Smartmodem 2400

Hayes Microcomputer Products, Inc.

5923 Peachtree Industrial Blvd.

Norcross, GA 30092

(404) 499-8791

List Price: \$895

When Dickinson arrived home with modem in hand, he hooked up the modem and fired up CROSSTALK to dial MCI Mail. Unfortunately, CROSSTALK insists on a particular setting for the DIP switches on a Hayes Smartmodem, and the factory settings on the new 2400 apparently weren't right.

Dickinson calmly opened up the front panel of the modem to reset the DIP switches. Then he did what he always does when confronting adversity in new communications equipment. He picked up the telephone and called Stone.

"I'm having a little problem here," he said solemnly.

"Oh really? I just plugged my modem in and it worked."

"Well, there aren't any DIP switches in here."

Sure enough, Dickinson was right. Chapter 6 of the

Smartmodem 2400 manual proudly proclaims, "No DIP Switches!" as the title of its first section.

It turns out that the Smartmodem 2400 has a new set of commands, and an on-board non-volatile memory to record its settings. Unfortunately, the new commands give you more ways to do more things than the manual controls (mostly DIP switches) on the Smartmodem 1200 do.

Mixed Messages

What was interfering with CROSSTALK, however, was the Data Terminal Ready (DTR) setting. The Smartmodem 1200 has a two-position DIP switch for this setting. But the 2400 gives you a choice of four settings to type in. Figuring out which of the four settings to use took some doing.

Thanks to this new feature, it took an hour to make the new modem operate with CROSSTALK. Not too promising, considering that it only took about 5 minutes for Stone to straighten Dickinson out when he got his Smartmodem 1200.

Though there were other

complications, there are two fine features worth noting.

The 2400-baud modem works at 300 baud using the Bell 103 protocol, at 1200 baud using the Bell 212A protocol, at 600 baud or 1200 baud using the CCITT V.22 protocol, and at 1200 baud or 2400 baud using the new CCITT V.22 bis protocol. That's a great feature in that it gives the modem the ability to communicate with a maximum number of other modems. Also, when the Smartmodem 2400 answers a call, it will automatically set itself to match the protocol of the calling modem.

Chief of Protocol

Unfortunately, when you make a call, you have to tell the modem whether to use Bell or CCITT protocols. Otherwise, if the modem is set for CCITT, it won't know how to operate at 300 baud. And if it's set for Bell, it won't know how to operate at 2400 baud.

Setting the proper protocol is a reasonable requirement at 1200 baud, but at 300 baud and 2400 baud, it is an unnecessary source of confusion.

With the problem of the missing DIP switches solved, Stone and Dickinson finally established communications.

"Let me try sending you a file," said Stone.

He did, using Xmodem protocol at 2400 baud. Xmodem is a public-domain, error-checking protocol that divides a file into 128-byte blocks and sends them one block at a time. Xmodem users are accustomed to watching the confirmation message "Block xx confirmed." Slowly. One block at a time.

Even at 1200 baud this becomes tiresome. But at 2400 baud, the messages fly by. "That's amazing," said Dickinson.

Stone hardly had a chance to answer before Xmodem's end-of-file message flashed on the screen. "Impressive," he said.

No question about it: Once you get the settings right, the modem works. But, is the extra speed of Hayes's newest modem really worth the extra trouble, not to mention the extra money?

"Yes, definitely," according to Stone. "The electronic mail and database services are in the process of adding the higher-speed service. When that happens, the extra speed will translate directly into savings of time and money. If you do much file transfer between offices, the payback will be immediate." ■

IBM Snuffs Software

IBM has discontinued the following 30 software packages that had appeared under the IBM brand name. This group includes programs licensed from outside developers as well as programs from IBM.

Operating Systems:

DOS version 1.1

DOS version 1.1 US ENG AFE

DOS version 2.0 AFE ENG

Languages:

BASIC Programming

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UCSD-p FORTRAN D.S.*

UCSD-p Pascal Compiler

UCSD-p Pascal D.S.*

UCSD-p Runtime Library

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Peachtree Inventory Control

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PFS:File

PFS:Report

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People in the News: Wilton Jones

A populist president who's on the stump for better word processing.

BY CHARLES BERMANT

HARTFORD, Conn.—When Wilton Jones turned 40 last year, his employees chipped in and bought him a boa constrictor. The beast was christened Multi and spent its days slithering in its cage in Jones's office. Jones eventually took Multi home when too many intimidated visitors convinced him the snake wasn't a proper business ornament. Besides, it probably made using a mouse in the office difficult.

Multi, of course, is short for Multimate International, manufacturers of *MultiMate*, one of the better-known (and higher-priced) word processing programs for the PC. As president of the privately held company, Jones doesn't need to run for reelection or ingratiate himself to a fickle constituency. The only vote that matters is dollars earned.

But in many ways Jones acts the role of the politician. Like a candidate on the stump, he is often on the road promoting his program in front of user groups. He eschews traditional marketing procedures, instead taking the product's message directly to the people.

Vote for Me

Jones says *MultiMate* has a solid customer base because the company goes out of its way to listen to criticism. He does much of that listening himself, personally addressing customer groups and participating in "some hot and heavy discussions."

Jones keeps an ear to the ground to prevent competitors from chipping away at his customer base. Not surprisingly, he sees MicroPro, manufacturers of *WordStar*, as a major adversary. But as of mid-January, he had neither used the new *WordStar 2000* package nor did he perceive it as a potential threat.



Wilton Jones

"We get worried about competition when a high-volume customer tells us that other programs are being recommended within the company that have certain features that we don't have," says Jones. "We are not hearing this about *WordStar 2000*."

A Wang Link

MultiMate was originally conceived as a bridge between two giants, seeking to bring the power and speed of Wang word processors to the IBM PC environment. Jones concedes that the company "doesn't do creative things, rather we supply creative ideas for solving customers' problems."

"We fit a niche that IBM doesn't have a product for," he says. "It may never have one, or it may have one next week. I have no idea how Wang feels about us. We trade technical information and have some con-

tracts. It seems gentlemanly."

IBM recently adapted the Displaywriter to the PC, something Jones regrets that he didn't have the resources to do. The PC version, *DisplayWrite*, hasn't decreased *MultiMate*'s growth rate, he says, but has affected the company's ability to increase it.

Promise Them Anything

MultiMate was one of the first companies to announce a special PCjr product, a custom word processor for the low-end IBM. A year ago at Softcon in New Orleans, Jones and his troops talked about the imminent release of *MultiMate jr*. However, as with so many other products announced for the PCjr during that machine's first life, Jones finally determined that the most optimistic projection of *MultiMate*'s market share would not cover its cost.

Now that the PCjr has apparently been rehabilitated, the project has been taken out of the deep freeze. With 40 of the more popular functions and a simple footnoting scheme, it is now slated for a May release.

Jones calls 1985 "a massive expansion year" for *MultiMate*. In addition to the PCjr package, a list manager and a graphics interface are waiting in the wings. In the near future, he hopes to market products that correct sentence structure and syntax as well as a hard disk word processor with a built-in thesaurus. The company is also in the midst of a substantial personnel infusion, doubling the technical support and research and development staffs.

Furthermore, Jones strives to extend the horizons of the vertical market. Lawyers, educators, engineers, executives, and secretaries will soon have their own versions of *MultiMate*. Jones says that all the features could have been put in one package,

"but then the manual becomes too big and the customer gets intimidated."

Iaccoca Cockamamie

Jones did not graduate from college but has always held jobs where that credential is taken for granted. Once, after working at a company for about a year, he was asked to supply educational background for inclusion in a corporate brochure.

He had not told his employers he lacked a college degree. The company was then in a quandary. It couldn't advertise Jones's lack of education, and owing to his visibility he couldn't be omitted. So they did the only sensible thing—they cancelled the brochure.

Jones has gleaned management techniques from a lot of different places and credits his success in running *MultiMate* to a synthesis of other's ideas. He's read all the popular business theories—he was halfway through Lee Iaccoca's autobiography at the time of this interview—and by those yardsticks has done everything wrong.

The sign on his door, which is often open, features one word, an unpretentious, homespun "Will." After the sign was first posted, he noticed a lot of signs with fancy titles started to disappear—until a woman executive adorned her own door with a sign reading "Queen Bee."

Throughout *MultiMate*'s expansion, the wise men of business have told Jones his unconventional management techniques won't work when the company grows to a certain size. Now, with almost 200 employees, he's hearing the same song. But his homespun shrewdness is still paying off for the company. And if it doubles in size once again, his style is not likely to change. ■

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Rather than relying on will power, The Original Boston

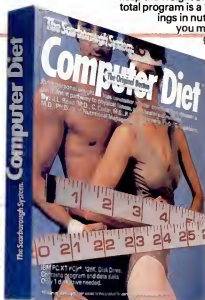
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Down Time



BY WINN L. ROSCH

Finding a new and clever product among personal computer offerings is about as rewarding as searching the "out" basket of a Xerox machine for an original idea. Maybe I'm jaded, but I can no longer get excited about yet another multifunction board/add-on hard disk/graphic card—whatever hot product that's new on the market.

Workless Station

DEST Corporation
1201 Cadillac Ct.
Milpitas, CA 95035
(408) 946-7100

List price: \$5,995 to \$9,995 depending on the number of fonts the model recognizes.

Requires: Serial port and communications software

In the midst of the sea of sameness, however, one product caught both my eye and my fancy—DEST Corporation's so-called Workless Station. Despite its moniker, implying that the Workless Station does nothing, and/or that you accomplish nothing with it, the machine is my favorite toy of the current hardware crop. Not only does the DEST device make genuine magic, but it also portends the future of personal computing. Its existence probably even hastens the arrival of the hereafter machine.

What makes the DEST unique is hunger for hard copy. It has a voracious appetite for

typewritten text, gulping down words, paragraphs, and pages and turning them into electronic ASCII characters, suitable for filing on hard or floppy disk.

The DEST is an Optical Character Recognition (OCR) device. Using special photodetectors, it optically matches character patterns on paper with those stored in its memory to find which ASCII symbol a printed character represents. The device then sends the best match, actually a whole page of them at a time, to a host computer through a common RS-232C connection.

Prehistoric Machines

Certainly OCR machines are nothing new. Back in the dinosaur days when I passed through college, OCR contraptions graded Board tests and exams. The typical dawn-of-time OCR beast was about the size of a small Latin American nation and could decipher only a very special form of printing, either the simple smudgings of a number 2 pencil or a typeface that strained the aesthetic limits of human understanding.

The DEST, on the other hand, takes up about as much desk space as an ordinary PC system unit and allegedly reads nearly a dozen typesets, automatically selecting from its memory the font that best matches the text fed to it. I say *allegedly* because, as with everything else in the PC realm, factory claims for the DEST and reality vary widely. DEST, however, seemingly errs on the conservative side!

The official diet for the DEST is typed text from only IBM Selectric-series typewriters. Officially, the typeface must match one of 11 approved fonts, and according to the factory, the DEST can recognize only characters printed using film (or mylar) ribbon.

If all those restrictions were set in stone, the DEST would

earn a mere ho-hum. More to the point, it would have failed my primary test (the ulterior motive behind my interest in the machine)—reading the manuscript of a novel of 500-odd pages that I had typed years ago.

A Novel Test

As with most first novelists, my penury prevented me from acquiring an IBM Selectric; so I borrowed a \$200 Smith-Corona portable from my grandmother for the finger exercises. Now that I am older and wiser, I punch out my prose on a PC. I have dreamed of honing my past creation to perfection (to make it salable), but alas, I have not been willing to devote a large fraction of my life to keystroking the 75,000 words of masterpiece into the computer.

With more curiosity than hope, I fed the first few pages of novel through the automatic feed mechanism of the DEST. It liked them. Thereafter, every 15 seconds or so another page of text would appear on the screen of my PC. Six weeks of keystroking were reduced to a single afternoon of tending the paper tray. The biggest problem I encountered was the DEST interpreting my Smith-Corona lowercase *J*'s as uppercase.

In my later experiments the DEST had no problem reading the work of a cloth ribbon that was faint enough to give me eyestrain. Despite its maker's claims to the contrary, the DEST even did a respectable job reading typewritten characters that were printed at the wrong pitch.

To be honest, the DEST's error rate climbed as its meals deviated more and more from its preferred fodder. I found that carbon copies and bad Xerox copies were unreadable. But when the DEST had its doubts about a character, it merely substituted an @ symbol for the ambiguity. A simple search

with my favorite word processor located all the errors in a few seconds. Applying a modicum of human control, I typed in corrections.

Curses!

As much as I praise the machine, I must curse its ancillaries. The DEST's instruction manual is inadequate; it doesn't even detail communications settings for the serial port. No software is supplied; you must scrounge for a communications program to run your serial port and capture the characters to disk. If you're not a computer guru, you'll have to depend on your DEST dealer to get your system working.

But more important than those practicalities are the possibilities wrapped in the DEST. The promise of the DEST and its technology is astounding. In its simplest application you might use it in your office to capture any typing to disk. Publishers could use such a device to read the manuscripts submitted by authors and convert them into a form suitable for electronic editing.

Scan Plans

The DEST also holds the possibility of speeding the personal computer revolution. With little refinement, the device could read text from books, magazines, or other printed materials and convert it into electronic form. At a fraction of the cost of keystroking, all the libraries of the world could be reduced to electronic form for instant computer access.

DEST claims to be able to make such a book-reading machine and only awaits mass storage technology that can hold its outpourings (so says a company representative). With personal computer laser-optics systems just around the corner, it's possible that soon you may have the knowledge of the world at your fingertips. ■

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PRODUCT REVIEW

Searching for True BASIC

BY JOHN M. WORAM

Editor's Note: This is the fourth in our continuing series of reviews of the various BASICs now on the market.

True BASIC

Addison-Wesley Publishing Company, Inc.
Reading, MA 01867
(617) 944-3700
List price: \$149.90
Requires: 128K (192K recommended), DOS 2.0 or later, one disk drive.

More than 20 years have elapsed since John Kemeny and Thomas Kurtz introduced BASIC to their students at Dartmouth College. Since then they've watched their handiwork get twisted into various dialects, which they now call "Street BASIC."

But at last, the creators of the original and by now much-abused BASIC have taken the time to give us their idea of what their baby should really look like, 20-plus years later. They call the language True BASIC and report that it is based on the American National Standard draft for the language, as it appeared in December 1984.

True BASIC comes with a reference manual and a user's guide. According to the authors, the former defines the language and describes how it works; the latter contains IBM PC system-specific information and a quick introduction to True BASIC structure.

Say Hello

When you load True BASIC (by typing "Hello" from DOS), a horizontal line splits the screen. At the top a 17-line editing window is used for viewing and writing program listings. Just below is a 7-line "history" window, where you enter commands and where the screen output from your program appears.

The proportion of editing-to-

history window space is easily changed with the SPLIT command, and depending on the nature of your programming, the split screen may be a labor-saver or a real nuisance. During heavy editing sessions and shakedown cruises, having part of your listing always on screen is nice, so long as you can still view a reasonable amount of program output down below. But if you need to see a full screen of output, you must type SPLIT 0 before running the program. Afterwards, you must retype SPLIT (pick a number from 0 to 24) to see your listing again. You can get annoyed fast.

For routine editing, remember to stay away from the LIST command. In True BASIC, LIST is used as the equivalent of LLIST in PC BASIC. If your printer is off, the system just locks up, with no error warning or device time-out message. How do you list a program on

screen? Eventually it dawned on me: you don't need to. The program is always listed on-screen in the editing window. Of course.

Unnumbered Account

You can write programs with or without line numbers, and the first option almost seems to be just for the convenience of old-timers who can't get along without numbering things.

With True BASIC, forgetting about line numbers is a lot easier than with PC BASIC. This difference might have something to do with what appears to be a bug, though. The reference manual says that you can enter line numbers in any sequence and that a new line number xxx will replace the old one—just the sort of thing you'd expect. But it doesn't work that way. The editing window will gladly accept two or more lines with the same number, all of which are kept on screen. And if you enter line 200 between lines 300 and 400, that's just where it stays.

In either case, program exe-

cution halts with an "Illegal Line Number" message, which doesn't appear in the appendix of error messages. The command for copying one or more line numbers to a different location doesn't work either. The PC-specific user's guide doesn't comment on this problem, but it does introduce a function-key Copy mode that does work.

So forget about line numbers. After programming a few lines of True BASIC, you'll wonder why you ever bothered with them. To insert a new line, just put the cursor in the right spot and press Enter. If you do so in the middle of an existing line, everything after the cursor appears on the new line. Changes are made as you enter them; you can wander through the listing using the cursor keys, make a change here and there, and press P9 to run the program, without ever touching the Enter key. By the way, F1 and F2 move the cursor back and forth between windows.

Cursor Changes

Although the Insert and Delete keys work the same as in PC BASIC, the cursor shape is the opposite. A normal blinking-underline cursor signifies the Insert mode, while a full-size solid box indicates that Insert is disabled. A nice touch has been added: the Insert mode stays on until you turn it off, which makes insert-editing tasks a lot easier.

The renumbering command is not one of True BASIC's stronger features. Renumbering a program with less than 20 lines takes as long as almost 20 seconds.

Getting a hard-copy printout is not quite the routine matter it is in PC BASIC, since the PrtSc key doesn't seem to work at all, and no LPRINT statement is available. Furthermore, PRINT USING "###.###" doesn't work either. So you must change your program lines to:

```
OPEN #1: #1: PRINTER
LET AS = "###.###"
PRINT #1, USING
AS: V
END
```

(continued on page 58)

Speaking of Computers:

Mid-Career in a Mid-Decade

"If you were unemployed in the mid-1970s, you called yourself a consultant. In the mid-1980s, you call yourself a venture capitalist."

—Roger M. Loeb, president of
International TeleConferencing
in letter to Inc. Magazine, December 1984

Dreams of E.T. and 1-2-3

"On [Eather] Dyson's panel, various experts counseled software producers to seek a niche rather than trying to be another Lotus."

"But some of us want to be another 1-2-3," said a software publisher from Florida. "That's how our industry will grow."

"Yes, and some of us want to be Elizabeth Taylor, too," said Ms. Dyson."

—Mike Greenly's report from Comdex
in Part I's "Comdex" conference on The Source

True BASIC (continued from page 57)

By the way, True BASIC requires both the LET and END statements, and each statement must be on a separate line. So you must rewrite the following line as seen here:

```
PC BASIC
A=3 : N=5
```

```
True BASIC
LET A=3
LET B=5
```

On the plus side, you can (in fact, must) use a Pascal-like structure, as in:

```
PC BASIC
IF A = B THEN C =
D ELSE C = E
      True BASIC
```

```
IF A = B THEN
      LET C = D
      ELSE
      LET C = E
END IF
```

This saves all sorts of grief when you're writing those hairy lines with all sorts of IFs, ANDs or ELSEs in them.

Work Savers

Programs are normally saved as ASCII files, although saving a compiled version as well is easy. First, use the SAVE FILENAME command in the usual manner. Then, type COMPILE, followed by SAVE NEWNAME. This procedure saves both versions to diskette.

If you don't want to bother saving the ASCII version, just ignore the first SAVE command described here. To save a program with a name that already exists on diskette, you must use the REPLACE command instead of SAVE. This method makes destroying last night's work by accident that much harder.

Drawing Card

Graphics programs seem a lot easier in True BASIC, although as usual in this series, I haven't been able to figure out a way to switch screens in mid-program.

The FLOOD statement is a welcome improvement over old PAINT. Consider a small solid-red rectangle sitting inside a

large green circle which has a black background. If X and Y are the coordinates of any point within the circle (but not within the rectangle), the statement FLOOD X,Y will fill the circle with green, except for the area already occupied by the rectangle. In contrast, the PAINT statement fills in the entire circle, erasing anything that may already be there.

Speaking of color, pressing Ctrl-F, -B, or -E changes the color of the foreground, background, and edge (or border). Although not mentioned in the manual, Ctrl-F also works on the green screen to toggle between normal, bright, underlined, and black.

COMPARISON CHART

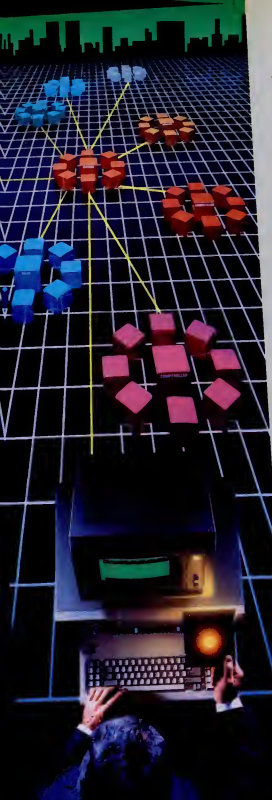
Program Features	True BASIC	Microsoft PC BASIC
Program Size (bytes)	99,536 (main program) 32,607 (ext. programs)	25,984 (BASICA V2.0) 26,880 (BASICA V3.0)
Programs saved as	ASCII file, or object code	ASCII file, or Compressed binary
Simple Bubble-Sort		
Program saved in (bytes)	334 ASCII 268 compiled Almost	314 ASCII 237 Compressed-binary n/a
Directly Compatible with PC BASIC		
Extended ASCII (128-255)	Yes	Yes
Line Numbers	Optional	Required
Labels	Yes	No
Dynamic Syntax Checking	While compiling	No
Dynamic String Length	Yes	Yes
Maximum String Length	32,767	255
Numeric Data (Ranges)		
Line Numbers	1-99999	0-65529
Floating-point (claimed) (observed)	1.11254E-308/3.59539E+308 same as claimed	2.934E-39/1.70E+38 same as claimed
542859.9114 on HP41 =	542859.911377018	542860
Decimal Accuracy	14 digits claimed 15 digits observed	6 (7th digit may be rounded)
Execution Speed Comparisons (in Min:Sec)		
Bubble-Sort of 50		
Random Numbers	2:40 (from ASCII file) 2:25 (compiled file)	1:25
Draw & Paint One Circle	0:09	0:09
Math Loop	0:04	0:04
Screen-Switching	?	Yes
Documentation		
Content	Good	Good
Clarity of Presentation	Very good	Poor
Physical Appearance	Excellent	Very good
Index	Adequate	Good
Slip-Case for Manual	Yes (light cardboard)	Yes

BASIC Training

Version 1.0 of True BASIC is probably the easiest-to-learn of all the BASICs I've had the pleasure of reviewing. The review copy of the user's guide is a rough draft; the index is still in preparation. I hope the final index is better than the annoying one in the reference manual, which lists many irrelevant appearances of important entries. With that warning aside, both books have been well produced and look good, even though finding what you want is not always easy. An alphabetical guide to all the commands and statements would be a big help.

Come to think of it, I haven't even been able to find a simple list of True BASIC's complete vocabulary in either book. A quick reference card is included that displays selected (that is, incomplete) True BASIC syntax, but with no explanations offered. This omission became apparent when I went searching in vain for something equivalent to PC/B's SWAP statement.

True BASIC deserves to be on the shelf of anyone who hasn't fallen for all that "real programmers don't write in BASIC" nonsense. The language is the work of two real programmers who do write in BASIC very well. I can hardly wait for Version 2.0. And for the serious student of the language, Addison-Wesley is about to release the authors' book on the history and the evolution of the language, *BACK to BASIC*. ■



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The Power Patrol

Watch your PC go with the flow using the current crop of voltage regulators.

BY M. DAVID STONE

If you're like most people, you probably haven't thought much about the electricity you feed your PC. You've simply plugged your system into the closest outlet without a second thought. Even if you've wondered about potential power-line problems, the odds are pretty good that you haven't done much about it.

Very often you can get away with this kind of benign neglect, but the exceptions can be expensive. I know. I chewed up two disk drives in a year before I thought to check the voltage on my lines. It turned out to be higher than my equipment was designed for, and there hangs a cautionary tale.

The first thing you must understand about power lines is that "normal" covers a wide range. My local utility is typical. It claims to deliver 110 volts on some lines and 120 volts on others. What's more, the utility considers itself within prescribed limits as long as the actual voltage on the line is within 10 percent of the claimed value. This means that the normal voltage from an electrical outlet may be anywhere from 99 volts to 132 volts. This range applies pretty much throughout the country.

Comfort Range

Unfortunately, this is a slightly wider range than most computer equipment can com-

fortably deal with. The IBM PC, XT, and PCjr, for example, are designed for a nominal 120 volts, with a range that runs from 104 volts minimum to 127 volts maximum. The AT is also designed for a nominal 120 volts, with a range that runs from 100 to 125 volts.

These voltage ranges are not absolute. You can run your system on a slightly higher or lower voltage than it's been designed for, and it will still work (or at least you won't destroy anything immediately). But as you begin to push the tolerance limits of your system, it becomes more vulnerable to damage from other electrical problems.

That's what happened to my disk drives. The voltage in my house turned out to be on the high side—128 volts on a regular basis. The drives eventually succumbed.

Obviously, it's better to find out about a steady overvoltage or undervoltage before it destroys your equipment. You can do that easily enough by getting a voltmeter to monitor your line voltage. (Voltmeters are available for as little as \$10 from Radio Shack or similar stores. Any store that sells them should have someone who can show you how to use one safely.)

You will probably find that your voltage varies with time. The trick is to check it over several days and at differ-

ent times of the day. Once you have a sense of what the usual voltage is, it's a good idea to spot check it occasionally—just to make sure. In particular, you'll want to check it during peak usage periods in the summer to see how low the voltage goes during intentional electrical brownouts.

If the voltage consistently

should consider investing in a voltage regulator.

A typical voltage regulator can take anything from 100 to 130 volts as input and produce a steady 120-volt output, give or take 2 or 3 percent. It's worth noting that some voltage regulators can handle a lower or higher input than this. Be sure to check the range for any given device

Power Protection

Here's a short list of voltage-regulator manufacturers.

Computer Power Inc.
124 W. Main St.
High Bridge, NJ 08829
(201) 735-8000

Gould Electronics
2727 Kurtz St.
San Diego, CA 92110
(800) 854-2658
(619) 291-4211 in CA

Shape Magnetronics, Inc.
901 N. Dupage Ave.
Lombard, IL 60148
(312) 620-8394

Sola
1717 Busse Rd.
Elk Grove Village, IL 60007
(312) 439-2800

Sun Research, Inc.
Box 210
Old Bay Rd.
New Durham, NH 03855
(603) 859-7110

measures in the 110 to 120 volt range, you don't have a problem. But if the voltage tends to run higher or lower than this, keep a careful eye on it. If you find that it consistently goes above or below the range your equipment is designed for, you

and match it to your needs.

In addition to protecting your system from brownouts and chronic overvoltages or undervoltages, a voltage regulator provides protection from minor voltage variations. But it doesn't even come close to providing complete protection from all power-line hazards. Some voltage regulators come equipped with other protective devices as well, but the regulator itself is a specific solution to a specific need, and it won't automatically solve all your power-line problems. ■



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PC Update



BY TOM BADGETT

I usually love surprises, but not in my computer software. Not even good surprises are all good—after all, what else might be lurking in there?

I got a bad surprise recently from *Nutshell*, one of my favorite data filers. I had found *Nutshell* a joy to use because it is so logical. You design records with a flexible editor. On-screen prompts and one-key help commands step you through any operation. Flexible input/output masks show on the

screen what you get in the file and on the printer.

I had used the product for dozens of quick-and-dirty data jobs and it worked like a charm. Then one day, while I was trying to catch up on my name and address file, *Nutshell* died. I lost everything I hadn't backed up. It scared me to death, and so I put *Nutshell* away.

But this story has a happy ending. Leading Edge, exclusive distributor for Nashoba Software's *Nutshell*, has released a late version that apparently fixes this bug and adds several enhancements. Nashoba programmer Spec Bowers tells me the problem was in the record delete routine. When records were added after a sort, the old sort list was deleted.

Building Better Nutshells

The latest version, 1.28, will merge *Nutshell* files and create new *Nutshell*-format files from an existing one. You can convert *Nutshell* files to *dBase II*, *DIF*, and *ASCII* files with

comma separators. And, the program now supports 35 popular printers. Version 2.00, said to be 2 or 3 times faster than previous versions, is just about ready for release.

Safe at Last

The *RECOVER* program with the new versions should help restore nearly all the data from a file damaged by the earlier versions of the program. You can also use the *Nutshell*-to-*Nutshell* conversion routine to work around file problems. Bowers says he has recovered more than 95 percent of all lost data, once he gets his hands on the disk. So if you have file, hardware, or even media problems you can't resolve, contact Spec Bowers (Nashoba Software, 2 Lewis Street, Lincoln, MA 01773, 671-259-0906).

I've tried several files with the new *Nutshell* including the large *NAD* file that caused me so much trouble earlier, and it seems to work fine. Bowers says it is safe, and so far I

haven't found anything to the contrary.

If you're already a *Nutshell* user, just make sure you have the latest version. If you're still looking for a powerful, easy-to-use, inexpensive (\$100) filer, this may be it. If you bought a version earlier than 1.28 after August 1984, tell Leading Edge [225 Turnpike St., Canton, MA 02021, (800) 343-6833], and it'll send you a free upgrade. If your *Nutshell* is older than August 1984, call Leading Edge anyway. You can get the new version for \$20.

I still think *Nutshell* is one of the slickest single-file data managers around. Sure, I'm now a little gun shy, but I'm starting to use it again, and it seems OK. Record and file size are virtually unlimited: at least 32,000 fields per record; each field theoretically could be as large as the largest layout, or 65,000 rows by 240 columns. If the new *Nutshell* works as well as it seems to, it is one of today's better software buys. ■

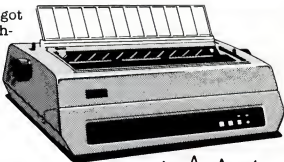
CALENDAR OF EVENTS

DATE	EVENT	COMMENT	LOCATION	CONTACT
April 20-21	Trenton Computer Festival	Retail show featuring exhibits, technical sessions, user group meetings, and computer graphics theater.	Trenton State College Trenton, NJ	Trenton State College Hillwood Lakes CN 550 Trenton, NJ 08625 (609) 771-2487
April 23-25	Federal DP Expo	Computer, data communications, and office automation systems.	Washington Convention Center Washington, DC	The Interface Group 300 First Ave. Needham, MA 02194 (617) 449-6600
April 24-26	UNIX Systems Expo	Conference for users, resellers, and producers of UNIX-based systems.	Moscone Center San Francisco, CA	Computer Faire, Inc. 181 Wells Ave. Newton, MA 02159 (617) 965-8350 (415) 364-4292 (CA office)
April 30-May 2	Sixth Annual On-line Meeting	Meetings and exhibits for users and operators of on-line database systems.	Sheraton Centre Hotel New York, NY	National Online Meeting Learned Information, Inc. 143 Old Marlton Pike Medford, NJ 08055 (609) 654-6266

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Company Offers FREE OVERNIGHT DELIVERY!!!

New customer service policy expected to set a new standard in the mail order industry!

BY MICHAEL CHRISTOPHER

GARDEN CITY, N.Y.—Mr. David W. Pasternack, President of Logisoft, a major IBM PC software and hardware distributor, has announced the inception of a unique new customer service policy. . . . free overnight courier delivery on their entire product line.

In a recent interview, Mr. Pasternack stated that "We feel our new free overnight delivery service will set a new standard in the computer software mail order industry. In a study we conducted, we found that in addition to competitive pricing, expedience was a factor utmost in our customer's minds. Whether their order was \$300 or \$3000, the need to get their package as soon as possible was the same. Under our old procedures, between processing and shipping time, it could take up to a week and a half to two weeks for an order to arrive. With our new courier service, an order can be processed, shipped, and arrive in our customer's hands in only 3 working days. . . . at no additional charge!"

The company is using Emery Worldwide to handle the large number of packages being shipped each evening for next day delivery. "We chose Emery for their competitive pricing structure and excellent delivery record", said Mr. Pasternack. Emery was quoted as saying, "This makes Logisoft the largest single Emery account in the New York Metro area."



LOGIC TIP OF THE MONTH

Choosing software can be mind-boggling. With the proliferation of publishers, how do you choose. Analyze your needs. . . what specific tasks do you want to perform. Read the software reviews; an excellent way to evaluate a package. Ask around. . . you'd be surprised how many associates may be using a package similar to your application. Finally, choose the best package (not always the most expensive). Upgrading will end up costing you more. Remember the key word is research.

TOLL-FREE SUPPORT A Smashing Success

GARDEN CITY, N.Y.—A survey of Logisoft's toll-free technical support policy was done to see if it warranted the continued costs of the 800 toll-free number, personnel costs, etc. After careful monitoring of these calls (both pre-sale and after sale) it was found that 92% of the calls were for legitimate technical support questions rather than for answers already contained in the software's operations manual. As a result of the survey, the decision has been made to continue toll-free support as an important part of their customer service.

This service consists of assisting with: • Hardware requirements • Initial boot-up procedures • Initial software configuration (printers, disc drive, etc.) • Back-up procedures • Defective program determination • Alternative program recommendation • Return policy

Logisoft's Lowest Price Guarantee Still Effective

GARDEN CITY, N.Y.—Logisoft, Inc. has indicated that their long time policy of guaranteeing the lowest prices in the mail order market is still being offered and will not be affected by their new free overnight delivery service. "We will continue to beat any price by \$10" a company spokesman said. "We'd be crazy to fool with success", he stated; "since the inception of our lowest price guarantee, sales have skyrocketed."

When asked how Logisoft could afford to give their customers free overnight delivery plus beat any price by \$10, they replied "Buying Power". "Very simply", they said, we buy at the best possible prices and pass those savings along to our customers".

CONTINUOUS STATIONERY: BIG BUSINESS, But "Where's The Class?"

NEW YORK—The growth of Logiforms, Inc., a member of the Logic Group, has been phenomenal. Mr. Ralph Corso, President of Logiforms explains why. "Up until now, buying continuous stationery through the mail has been a take what's available situation". "First off", he said, "almost all mail order firms offer only stock letterheads & envelopes with limited typesets, colors and stock logos from which to choose, but, 'where's the class?'"

"The individual style and design of a letterhead", said Mr. Corso, "reflects the professionalism and personality of a company and should not have to change because they now have a printer and the need for continuous stationery. While other mail order firms are limited in the variety they can offer, Logiforms specializes in custom stationery. Logiforms offers a large selection of quality paper, ink colors and special effects such as thermography, blind embossing, foil stamping and multi-color printing." Mr. Corso went on to say that

"whether a customer chooses to supply his own artwork or printed letterhead, or wishes to select from our vast array of stock designs. . . . We are the Logical Choice".

For a free sample/pricing kit and a handy re-usable shipping envelope for artwork, simply call toll-free 1-800-645-3491 or send a sample of your current stationery for a free firm price quote. Mail to Logiforms, Inc., 300 Garden City Plaza, Garden City, N.Y. 11530

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2030 \$ 319	Color 600 479	HERCULES	Smart Cat 1103/212 \$439
8092 349	Color 700 579	Graphics Card \$335	Smart Cat 1103 185
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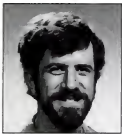
TEAR AND COMPARE!

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Parity Check



BY STEPHEN MANES

How much is software really worth? Remember, you read the definitive answer here: \$4.95. At most.

"Hold on!" cries the outraged software designer. "My program took 50 person-years to design! It's worth a whole lot more than five bucks!"

Not to the buyer, it isn't. Sure, Mitch Kapor tries to charge 500-odd smackers for the privilege of running *Symphony*, but the majority of the program's users are probably getting it for the cost of the floppy disk onto which they've illegally copied it—less than \$4.95.

The industry association ADAPSO (Association of Data Processing Service Organizations) claims that more than 50 percent of the software in use today has been filched. And that's just in the business community, where people are spending the boss's money, not their own. The percentage of illicit software in use in homes and educational institutions is undoubtedly even higher.

It's no surprise. Americans simply won't pay much for software. They never have, and there's no reason to believe they ever will. Down through the years, Americans have always taken pride in owning tangible things: houses, cars, TV sets, pool tables, cuff links, watches that play "Satisfaction." But they don't much care for items

that require expensive additional outfits—like computers.

Americans have always considered software intangible and disposable, so they expect it to be cheap or absolutely free. They'll pay top dollar only for software that uniquely fills a burning need. They're paying in the business world right now, but if history is any guide, they won't for long. And history has some unpleasant (at least for ADAPSO) suggestions to make about where the home computer market is heading.

Down Memory Lane

Television and radio, the two communications titans of this century, owe much of their success to an unbeatable price on the software that drives them: zilch. Both industries took off the instant a variety of free programming became available.

In contrast, the recent play-only video cassette and disk systems died a quick death. Their inability to record programs and the limited availability and high price of their software proved to be their downfall.

What succeeded instead was the video cassette recorder, which had two things going for it. Since software production was open to any fast-buck producer with a machine, it quickly created (as the haughty manufacturer-dominated player industry did not) a specific demand: pornography. And the vast amount of free broadcast and low-cost cable programming that an owner could record

assured the VCR's success. Machine prices plummeted and so did the prices of blank tapes and rentals—below the critical \$4.95 mark. The market now seems unstoppable.

Publishers, telephone companies, record producers, and film companies, of course, have never offered free software. Yet in every case, an information industry reaches mass audiences only when the software it sells is exceptionally cheap. And cut-rate new technologies always win out over increasingly expensive old forms.

Newspapers, for example, have always offered low-cost information. But an even cheaper competitor—free television news—has triumphed, forcing *The Daily Blat* to reposition itself in the marketplace.

Test Patterns

Movies have never been terribly pricey, but free television nonetheless dealt the movie industry a mean right hook. Now the VCR is delivering the coup de grace. Since many theaters are now charging more than the watershed \$4.95 price, they're likely to go down for the count.

Hardcover books have always been for the upper echelon. The emergence of the cheap paperback opened up a vast new market. But now, paperback publishers are meeting resistance as prices hit \$4.95. There's no evident alternative yet, but just wait until a subway rider can tape all 8 hours of "The Thorn Birds" and play it

back on her \$50 wrist-size Videoman.

Low local rates and a unique service made the telephone industry soar, but for years people sent telegrams rather than pay high long-distance rates. Improved technology made long-distance calls economical and sent Western Union a singing message: the funeral march.

The record industry beat radio to the market, coexisted with it, and eventually came to use it as a free advertising medium. But around the time when records topped \$4.95 apiece, the industry suddenly found itself in chaos. Millions of Americans switched to the cheap cassette tape, recording tunes off the air or sharing one record with half-a-dozen friends. The new laser-read compact disk, like the personal computer, will appeal only to well-fixed pioneers until software prices come down or the technology allows personal recording.

The pattern is clear: if the software's not cheap, the hardware won't sell. But that's in the consumer market, right? Isn't the business user conditioned by now to spending large sums of money for software?

Nope. Most firms are accustomed to spending large sums of money for tangible items like paper and files and humans to manipulate them, and are desperate to pare down their one big software expense—the phone bill. Many of today's computer users are encountering the machines for the very first time. They've never heard of the \$100,000 software tradition in the mainframe world. But you can bet they know what a blank disk costs.

For now, the sky may be the limit to software prices. But tomorrow? Well, unless they've got a very special product, software publishers had better be prepared to explain why it costs even a penny more than—\$4.95. ■

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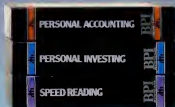
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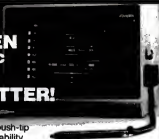
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5,000	3:30	48:07	16:58	*	45:26

*Could not successfully compile the program.

Execution Time Ratio

(Cibson Mix calculated S-Profile)

Realia COBOL	mkg COBOL	Level II COBOL	R-M COBOL	Microsoft COBOL
1.0	3.6	14.7	21.6	22.3

Sieve of Eratosthenes

0.818 seconds per iteration

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The Next Operating System

Visi On, Windows, DOS 4.0, TopView, and GEM all attempt to answer the question, "What's the next operating system for the IBM PC?" One contender stands above the rest.

It's no wonder that people just aren't getting as excited about operating systems as they once did. The industry has gotten pumped up time and again over this operating system or the other, each one promising to be the ultimate, only to be later let down by a system's shortcomings.

In time, of course, newer, more-powerful operating systems will enable personal computer users to be more productive. While few users are now asking for concurrency, it will soon become the norm, and operating systems that support networks will also be standard.

To date, operating systems have included some significant attempts as well as some notable failures. Visi On, for example, turned out to be too little performance too late. Its ideas were great; the visual interface a delight. It was simply too slow. Also it didn't have enough software vendors behind it. No one wanted to be trapped into using only Visicorp's application programs, no matter how good they might be, and everyone was put off by the endlessly extended delivery dates and rumors of problems. So they waited. Like a seed that tried to germinate on a flagstone, Visi On withered and died.

Then, with appropriate fanfares, Microsoft announced Windows. There was no wait for anyone to jump on the

bandwagon. In fact, the bandwagon's springs were sagging from the sheer weight of the compatible manufacturers that climbed aboard. However, IBM didn't buy a ticket. A great tangible sense



Bill Machrone

of foreboding hung over the product as everyone rallying round the window realized that IBM was in the parking lot pouring sugar in their gas tanks.

Windows had it all: DOS compatibility, bit-mapped graphics, tiled windows, concurrency. What it didn't have was IBM's imprimatur. And then came the rumored delays. The rumors became real, and manufacturers began falling by the wayside as they ran out of money and guts. Still, the Microsoft smithies forged on toward a glorious but unknowable

end. We're talking in the past tense about a product that hasn't even been introduced yet—not a good sign.

DOS the Way It Goes

From other quarters in Microsoft come rumors of DOS 4.0. This apocryphal product has more identities than an international terrorist. It's a single-user UNIX. It multitasks. It's a network version of DOS. It windows. It communicates. It's hardware-dependent. It's hardware-independent. It's easy to use. It's programmable.

I'm as strong a proponent of UNIX as anyone—for the right applications. Too many people buy networks when what they really want is a multi-user system. They want multiple simultaneous access to data by a variety of users, but they also want PC compatibility so they can tap into the wealth of available software. Also, the influence of people who program in a UNIX environment is way out of proportion to those who actually use UNIX-based systems. A single-user UNIX may be swell for program developers, but it doesn't have much to recommend it to end users. An operating system more closely tailored to the needs of end users and to the increasingly graphic nature of today's applications would be more to the point.

DOS 4.0 had better be more than a sin-

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gle-user UNIX if it is to become the operating system of the future.

Enter TopView. Personally I'm underwhelmed. The future lies in bit-

mapped, full-color screens. And although TopView can run graphics programs, it is character oriented. It doesn't have a consistent user interface between

traditional (read: old-fashioned) character-oriented displays and the emerging full-graphics displays. It does have some very nice features, however, such as PIFs (program information files). Before it was even introduced, TopView became the de facto standard for operating-system-to-program interfacing.

Now TopView itself may be eclipsed by GEM. Peter Norton says that GEM on a Junior will run circles around TopView on a PC AT. John Rowley, president of Digital Research, claims that GEM emulates DOS 3.1 calls, right down to the network support. And while GEM lacks concurrency, it runs fine with DRI's Concurrent PC-DOS.

GEM is also the operating system of choice for Atari's new 68000-based "Jackintosh." As this amazing little machine takes hold, it will define user expectations not just for low-end computers but for all computers.

It's Your Move, IBM

If I were IBM, I'd be strongly tempted to endorse GEM for the PC lineup. After all, IBM's personal computing fortunes are hung on the 80286, and it is also the chip of choice for the multitasking version of GEM. DRI already has a version that uses the full 286 protected mode. Not only does GEM work with PC Network, but chances are good to excellent that DRI has an add-on to GEM in the wings that will display a graphic representation of what the network is doing.

IBM is likely to take some offensive measures to forestall the Macintosh Office and Apple Talk. Apple has talked grudgingly of a link to PC networks as an eventual outgrowth of the Mac Office, but GEM may steal a march from Apple as well. Rumor has it that a Mac version of GEM exists—not a complete surprise since it already runs on the 68000. GEM on a Mac would mean data interchangeability with PCs and the same user interface for all. Of course, the Mac's interface would be monochrome, the PC's color. Who could ask for anything less?

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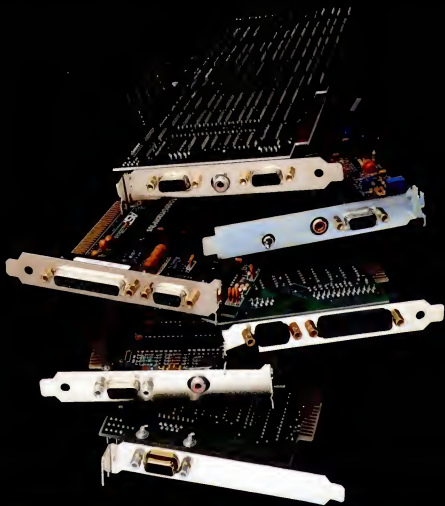
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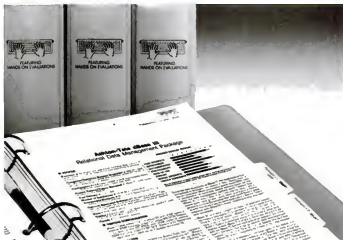
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Press the Return key  to select DISPLAY.

Press the down arrow key  twice to select ALL, then

press the Return key 

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Letters to PC

Looking for Scriptor

In "Other Voices, Other Futures" (*PC*, Volume 4 Number 1, page 133), comedy writer Harvey Berger mentions a program called *Scriptor*. I have been unable to locate the manufacturer of this program. I hope that *PC* can provide the publisher's name and address.

Kenneth Perrine, Ph.D.
Aiken, South Carolina

The software can be obtained by contacting Screenplay Systems, 211 E. Olive Ave. #208, Burbank, CA 91502, (818) 843-6557.

XyWrite II-Plus Redemption

In a recent issue, you published my letter criticizing *XyWrite II-Plus* ("XyWrite II-Plus Grips," *PC*, Volume 4 Number 3, page 96). I would like to revise my earlier assessment of the product and the company.

In response to a copy of the letter, I received a call from Dave Erickson of *XyQuest*. He followed up by sending me an updated version of the program that addressed every deficiency I noted, except for proportional spacing, which *XyQuest* plans to incorporate this year. He even customized a printer driver to provide the features I'd requested.

The reason for my problems was that I had been using a version that didn't include some of the program's revisions. For example, the file that set the program up for use with a color graphics adapter and a monochrome monitor listed inappropriate screen-characteristic designations. The manual mentioned that they could be revised and that the numbers could be obtained from the IBM technical manual. A lost letter and a misplaced message led me to believe that the company was unresponsive, which it is not. My contact with Mr. Erickson convinced

me that my conclusion was premature. He not only explained the procedure, but he sent me an example as well. The updated program erased my other complaints and left me with nothing but compliments.

After using my new version of *XyWrite* for a month, I can say that it is a superb word processing program. I've recommended it to others as enthusiastically as *PC* recommended it to me.

Richard R. Milewski
Garden Grove, California

More Networking

As a network consultant, I would like to commend you on the best effort to date of evaluating networks for the *PC* (*PC*, Volume 4 Number 3). However, I noticed several important items that were overlooked. You should have clearly listed the amount of memory each network uses in each situation. Networks can burn up to 128K of memory per station. This often requires users of Lotus's 1-2-3 to buy a memory expansion card



for each station at a cost of at least \$350 each. This hidden cost per station can be quite important to the overall cost of a network.

It is distressing to me that such a thorough evaluation could miss one of the most powerful networks, Network Development Corp.'s DNA, which requires only 4K per station. DNA runs with almost any software and allows you to op-

timize the network to the type of work you are doing. There are no problems using DOS commands, and the system works with PCs, PC/jrs, and ATs. The network is so flexible it enables you to use it with any hard disk system, and you can install other network cards if you like. I would like to see a review of DNA in a future issue.

Philip Yanni
Philadelphia, Pennsylvania

Auditing Solomon III

Although I agree with Price Waterhouse that Solomon III is a step in the right direction for small business accounting needs, there are severe problems with most of these canned packages that should be stressed in your articles ("Getting Wise with Solomon," *PC*, Volume 4 Number 2, page 218). My accounting firm's hands-on experience with Solomon III brought out many weaknesses in the product and in Price Waterhouse's review.

First of all, why are color monitors recommended for serious high-volume business software? Sure, it makes the product sell better in the store, but the resolution is so much worse than on a monochrome display that it significantly increases eye fatigue and lowers operator productivity. Our experience shows that any user with even moderate data-entry volume will choose a monochrome over a color display.

The article fails to mention the inability to modify this and most other canned software. Although at first this does not seem like a problem for packages that include a report writer, what about customizing invoices, purchase orders, and other documents? Our experience is that most small companies don't want to switch to someone else's invoice form, especially one that is only available from

LETTERS TO PC

an out-of-state supplier. Obviously, most users want to enhance their accounting software after a short period of time, and Solomon III makes it impossible to do so.

Solomon III only supports a 12.6-MB database. For most small companies us-



ing a job-cost system, this could force them to purge files more often than they wish to. Also, how fast does the software access and process records once the database is half full?

There are many nice features in Solomon III. It's a troublesome assumption when an accounting firm views potential users of products such as Solomon III as mom-and-pop store owners who won't need to have larger files, can't use larger hard disks, need color screens, and never need modifications—especially considering that accounting firms advise clients and install accounting systems more often than any other consultant.

Clark Dircz, CPA
Edina, Minnesota

PC Tells It Straight

I am a loyal Apple II owner, but thanks to the Burlingame Public Library, I am a loyal PC reader as well. No Apple magazine, including A+, comes close to the standards of reporting you set. And I know because I read all of them.

Your special issue on printers would make *Consumer Reports* proud (PC, Volume 3 Number 23). With the exception of your report on databases, no computer magazine has ever covered a subject so objectively and completely. No punches were pulled—the story was told straight. The consumer in the market for

a printer knows what to look for and how to look for it after reading an issue like that. Great work!

Larry M. Nebron
Daly City, California

I have been very impressed by the evaluation of hardware and software in *PC Magazine* lately. I thought the printer issue was superb. I realize that you are not *Consumer Reports*, but many people must either rely on their acquaintances, salespeople, or reviews like yours. Your comprehensive reviews appear to be the best choice by far.

Allen M. Scher, Ph.D.
Seattle, Washington

PCs for the Latin Market Only

Your article "Latin Bombshells Burst Over New PC Market" (PC, Volume 4 Number 1, page 49) missed the mark on a significant point. The article described our proposal to the Mexican government as a move to "create a new supply of foreign-assembled PCs, PC/jrs, XT's, and AT's for American consumption." IBM has no plans to market any Mexican-made IBM microcomputers in the U.S. if our proposal is approved. The vast majority of the proposed microcomputers would indeed be exported—not to the U.S., but to Latin American and other international markets.

Mexico's program of stimulating the economy through foreign investments permits majority foreign ownership of enterprises in the computer field.

What would Mexico gain from IBM's proposed project? There would be significant economic benefits, including sizable export volumes, new jobs, additional tax revenues, an improved balance of trade, and new business opportunities for the local industries that would supply many of the components, software, and technical and distribution services for the IBM system.

D. M. Linton
IBM
North Tarrytown, New York

Cleaning Up Your Hard Disk

In "Hard Disk Housekeeping" (PC, Volume 4 Number 1), Peter Norton discussed organizing your hard disk. Norton mentioned a software utility called *SPACEMAKER* from Realia, Inc., that will assist you in converting many .EXE files to .COM files.

I'd like to find out more about this product. Can you supply me with an address and phone number?

Terry G. Shockley
Winter Springs, Florida

The address for Realia, Inc., is 10 S. Riverside Plaza, Chicago, IL 60606, (312) 466-0642.—Ed.

Keyboard Complaint

I enjoyed the review of the IBM PC AT ("IBM Brings Out the Big Guns," PC, Volume 3 Number 22), but I disagree with the assessment of the new AT keyboard.

I do a lot of number crunching in my applications, and I use software such as Lotus's 1-2-3 and *Symphony*. My complaint is that there is no dedicated numeric keypad and corresponding cursor movement pad for the PC and AT like the one on the TI Professional Computer. Almost everyone I've talked to about the IBM keyboard complains about the lack of these features. I find it rather interesting that you did not note this as one of the more obvious design oversights by IBM.

Overall, it was an excellent review of what I am sure will turn out to be an excellent computer.

Dennis Morichetti
Pompano Beach, Florida

Paul Somerson replies:

While there's no dedicated number pad, all you have to do to switch between numeric and cursor mode is flick the NumLock key once—and the AT provides a light right over the NumLock key to show which state the pad is in as well as a metal divider to segregate the pad from the rest of the keyboard. Adding a dedi-

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cated cursor pad starts to make the thing look like a Chinese typesetting keyboard. Remember too that lots of users don't need a dedicated number pad—in fact, it would get in the way. Anyway, the IBM keyboard is miles above the competition in touch, looks, sound, layout, general ease of use, and every other standard I can think of.

Thank You, PC

This is a thank-you note. The other day, I was using WordStar when I got a "Parity Check 1 Error" message on my screen. Diagnostic tests revealed nothing, but I continued to get the error sporadically. Then I remembered reading PC's programming article on the parity interrupt interceptor ("Parity Insurance," PC, Volume 4 Number 2). I typed in the BASIC listing, loaded it, and finished a major project on time. Thanks. You just covered the cost of a subscription.

Robert C. Hanna
New York, New York

On-Line Jokes

Thank you for the mention of Comedy By Wire in PC News ("Do Disks Have a Laugh Track?" PC, Volume 4 Number 1, page 35). Comedy By Wire can now be accessed through The Source's menus or by typing PUBLIC 153 DIRECT. It is also available on Delphi, and hopefully the issues will be burned into the ROM chips of every new IBM computer very soon.

William Coronel
New York, New York

Review Process Flaws

After reading PC's rather exhaustive survey of IBM-compatible printers (PC, Volume 3 Number 23), it occurred to me that Bill Machrone's observation, "When you show people that the printer they swear by is an unmitigated turkey . . . they hate you," can be applied to your magazine as well. I swore by PC, but this issue was a big disappointment.

The methodological flaws in the test-

LETTERS TO PC

ing procedures make the reviews worthless as an objective assessment of printer quality. You did not provide a control for reviewer bias or unreliability of criterion measures.

PC should have hired a trained consultant who knows something about experimental design to monitor all of the reviews. The consultant could have made sure that all the testing procedures were standard. For example, all printers should have been loaded with the same type of paper. Each printer should have printed the same test output. Only one person should know which printer produced which test sheet. Then each reviewer should see the output sheets and rank them from best to worst. The consultant should then statistically analyze the rank orders of the printers and establish a final rank order. By using the blind method, each reviewer's prejudice is controlled because nobody knows which machine produced which output. Each reviewer has to rely only on objective assessment, not predetermined bias.

Carlos Y. Maldonado
Yonkers, New York

John Dickinson replies:

Mr. Maldonado raises a legitimate question about the method used in "Project: Printers," but he misses an important point of doing product reviews rather than product taste tests of the sort he recommends. A taste test may well show that 65 percent of the people tested prefer one product over another, but it doesn't tell me if I'm one of the 65 percent or one of the 35 percent.

A good review will contain a balanced mix of personal opinion and objective reporting. A good reviewer will let his or her biases be known so that you can compare them to your own. The reviewer should also differentiate between opinions based on those biases and conclusions based on researched facts. In PC's style of review, those researched facts will be printed right along with the review so that you can put the pieces to-

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LETTERS TO PC

gether and formulate your own viewpoint.

Just for the record, we did load each printer with the same kind of paper, and we did use standard test output, speed, and quality test programs for each. Those results are included in the charts and in the print samples.

Corrections:

The PC Caddy from Omnium Corp. has a suggested retail price of \$299, not \$99 as stated in New on the Market (PC, Volume 4 Number 4, page 291).

The last two lines from the review of X-Net in "Battle of the Network Stars" were inadvertently dropped (PC, Volume 4 Number 3, page 271). The sentence should have read as follows: "Improved documentation would make the system easier to install, but reliance on personalized, complex stored strings of characters means that you must have a programmer around to make changes in the network's configuration or function."

Because of an editing error, the article "A 22-Hour Library Card" (PC, Volume 3 Number 24) did not make it clear that Colleague is an electronic medical information service marketed by BRS/Saunders, a joint venture of TBG and the W.B. Saunders unit of CBS Educational and Professional Publishing. The correct number for information about BRS/Saunders's Colleague is (800) 468-0908.

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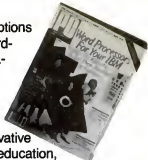
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It's Odds and Ends Time

Good news: the updated Word makes full use of IBM's EGA board; Businessland gives hottest delivery of new IBM products; and the Realia COBOL compiler brings the real thing to the PC.

This time around, I get to chat about some interesting tidbits that weren't substantial enough to be worked into a column by themselves, but are well worth discussing.

First, I want to follow up my column on IBM's high-powered and multifaceted Enhanced Graphics Adapter (see PC, Volume 4 Number 7, "Across-the-Board Surprises"). I mentioned that I'd bought two IBM Enhanced Graphics Adapters plus two graphics memory expansion cards for them and that two out of the four boards were dead or defective. I was wrong; three out of the four were bad. I discovered that one of the two good EGA cards works fine but fails to pass the IBM diagnostics test (the test can't tell me what's wrong). Three bad IBM boards out of four isn't a good record.

I also complained about how the EGA can only show off its wonderful tricks for specially adapted software, which means users have to wait for the EGA versions of *Symphony*, *Framework*, and so forth. In the meantime, however, I discovered that Microsoft is striving to maintain Word's reputation as the top-of-the-line, highest-tech (if not, easiest-to-learn) word processor and will soon release a new version that takes full advantage of IBM's EGA board. I previewed it and was impressed with both the EGA and

with Word's ability to make use of it. The new version of Word should be out on the market in the spring.

With both IBM's EGA board and related products hitting the store shelves, I



Peter Norton

want to discuss where you can get stuff that's in short supply. It used to be Sears. When the PC was first announced and later when the XT was released, everybody who got 'em first, got 'em at Sears Business Systems Centers. Lately, however, the outfit that seems to come through with the goodies long before anyone else is Businessland. Three times, in three different cities, Businessland was able to get me a hot new IBM product while other stores were sitting on my orders.

On the other hand, if you don't have a Businessland nearby, I still think that ComputerLand and Sears are dandy sources of supply.

The Doran Experiment

Another interesting topic is a clever experiment by Joseph Doran in Massachusetts. He uses the new Version 3 of my *Norton Utilities*, which includes a program called DiskTest (DT); the DT tests a disk for errors by test-reading all the files or, for a more thorough test, every sector on the disk. And while the DT is essentially a diagnostic and repair tool, Doran realized that it could also be used for performance testing. He did it with a batch file like this:

- ```
(1) TM START
(2) DT C: /D
(3) TM STOP
(4) CHKDSK C:
```

Lines 1 and 2 use the TimeMark program (TM), which is also a part of my utilities, to act as a stopwatch to time the hard disk test that's performed in line 2. Line 4 uses the DOS CHKDSK command to report the size of the disk, assuming you don't already know. Then, to get the performance figures, you divide the number of kilobytes of disk space that CHKDSK reports by the number of seconds-to-read that DT reports—

and you get a crude but effective measure of the transfer rate of the disk in kilobytes per second, which is the standard way of measuring these things.

Doran has been running this clever test on a variety of hard disks, and I'll summarize his results here. If hard disk performance matters to you—and it does in

some disk-intensive PC situations—you'll want to pay special attention to these numbers.

A stock XT, with IBM's hard disk in it, performs at about 44 kilobytes per second. I'll use that as a standard for comparison. Many users have been upgrading PCs to XT specs with add-on internal hard disks, such as the economical one sold by Maynard Electronics. Doran's test showed the Maynard performed at 60 kilobytes per second, an impressive 35 percent faster than a stock XT.

What did the Doran test reveal for the AT with its hot disk and hot processor? It showed that a stock AT hard disk performs at 70 kilobytes per second, or 60 percent faster than an XT. That result makes the Maynard look good too—its 60 kilobytes per second is within spitting distance of the AT.

As you probably know, one of the neatest design features of the AT is that it can accommodate 14 different hard disk types of varying sizes. The standard 20-megabyte AT hard disk is known as type 2 (type 1, by the way, is essentially an XT's 10-megabyte disk). Doran also plugged in a type 13 disk from IDEA. Type 13 is essentially the same size as the standard type 2, but with different dimensions: twice as many disk sides, half as many cylinders. It clocked in at 80 kilobytes per second, or 80 percent faster than the XT I've been using for comparison and about 15 percent faster than the standard AT disk.

When I hear more results or have more to say about plugging other disk sizes into the AT, I'll report them here.

### A Double Follow-Up

In "Hard Disk Housekeeping" (PC, Volume 4 Number 1), I mentioned one of my favorite programs, Realia Incorporated's *SPACEMAKER*, a program that squeezes down programs to smaller size and also converts many EXE programs into COM format. The first bit of follow-up is to give you the company's full address: 10 S. Riverside Plaza, Chi-

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cago, IL 60606, (312) 346-0642. The other bit is to tell you about its real product; *SPACEMAKER* is just an incidental by-product of the development of Realia COBOL.

Personally, I have a great distaste for COBOL, so I handed it over to Dean Gibson. Gibson is clever enough to do intimate systems programming on an IBM mainframe in COBOL, so I knew he would be able to do a full stress test of this compiler.

He was impressed. His only complaints were about the hard-nosed copy-protection, which is apparently done with ProLok and is a real nuisance; it's unusual for a compiler to be copy protected. (Note: The compiler itself is copy protected, not the programs you produce with it.) He also grumbled about how one source-code error typically cascades into a zillion error messages, but since most microcomputer compilers act that way, it's not a black mark for Realia.

Gibson was impressed that the compiler worked very fast and produced very tight code—and that ain't an easy task for a microcomputer COBOL compiler. He also liked the source-level debugger that comes with the Realia compiler.

## The Real Thing

What impressed me most—and I hate to say this because I hate COBOL—is that Realia implemented the *right* COBOL. Most microcomputer COBOL compilers have been scaled-down, limited versions of COBOL. Realia realized that toy COBOL compilers don't cut it on IBM PCs, so it implemented IBM mainframe COBOL-VS. In other words, it's not just standard COBOL—it's the full, real standard IBM mainframe COBOL.

I don't want to encourage you to use COBOL, but I know there is a lot of COBOL code out there waiting to be ported to PCs. IBM's solution to the problem of bringing mainframe programs to PCs was to produce the XT/370 and now the AT/370—two high-priced PC variants that can, under the right circumstances,

run mainframe System-370 programs unaltered on your very own PC. True, it's a great solution—but an expensive one. The Realia solution is to sell a CO-

BOL compiler that ought to be able to port all those mainframe COBOL programs to standard PC programs that you can run on any PC. Sounds great to me. ■

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Let's face it, we've all heard the horror stories of people who've lost data on their hard disk. True, it doesn't happen often, but then disaster seldom does. With the amount of data you can put on a hard disk these days, no one in business can afford even a small disaster.

**When did you last  
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Oh, you did it once with floppies

and it was so time consuming that now you've convinced yourself nothing will go wrong? In other words, it can't happen to you. And besides, at the prices they're asking for tape backup—\$2,000 and up—you're willing to take a chance. You've seen some tape drives for less, but you have to buy an expensive hard disk to go with it, and you've already got a good hard disk. Where can you turn for relief?

## IBM Compatible tape drive system complete for \$995

The Express Systems™ tape drive comes complete—half-high tape drive, controller, and software—for only \$995. It's absolutely IBM compatible—all 60 megabytes of it.

You can use your tape drive in the event your hard disk fails. And if you have to replace your hard disk, the tape's ability to read had sectors will let you replace your hard disk with another even if the new one is not error-free. The tape requires very low power, too.

And it doesn't poke along. It reads and writes at 90 inches per second (ips) and transfers data at up to 3.75 megabytes per minute in the streaming mode. You don't have to be a rocket scientist to figure that you can perform an image backup of a 20 megabyte hard disk in about 5 minutes. But practically speaking, once you hack up your hard disk completely for the first time, you never need to do more than invoke the archive command—that convenient command that tells your new tape drive to hack up everything since you last hacked up. If you backup as often as you should, your Express Systems tape drive will finish the job virtually in seconds.

The Express Systems software has additional benefits, like enabling you to use PC DOS terminology such as "...", ":", and "?". It also has a built-in reformatter, built-in verification (to make sure you transferred what you thought you did), and it's prompt driven, which means it asks you exactly what you want to do.

### Easy to install

Before you get intimidated about installing our tape drive internally, you should under-

stand that IBM doesn't think it's too difficult. They're selling IBM PC ATs with instructions on how to add additional hard disks in the *Installation and Setup* manual that comes with the AT.



The IBM AT installation manual shows how easily you can install internal storage drives yourself.

### We even provide the tape cartridge

Most people don't realize that the tape cartridge contains most of the critical mechanisms to insure data integrity. In order to be sure that you get the best insurance for your data (after all, isn't that why you're buying it) we encourage you to use Express Systems' specially tested tape cartridges. We're not going to kid you and tell you others won't work, but here's what's special about Express Systems' tape cartridges.

First, they are tested down four separate tracks from end-to-end, not just down the center of the first 150 feet, like some others do. We use three screws to hold the cover on instead of four. This simple triangular arrangement keeps the baseplate flat, just like three legs work better than four to make a table steady. Since all tape drives reference everything to



The Express Systems tape drives come with Express Certified™ 555 or 500 1/2-inch tape cartridges with quadruple end-to-end testing for extra assurance of your data.

whole day.

And finally, we will sell you tape cartridges in boxes of three instead of the usual five. So, you get higher quality with a smaller quantity commitment. And we compound the savings with a lower per unit price, just \$35.00 instead of the usual \$45.00 most retailers charge.





## Need a hard disk?

Depending on whether you have an IBM PC, XT, or AT you may want additional hard disk storage. We have those too. We offer 10, 21 and 31 megabytes of formatted hard disk storage.

For the most part, our drives are made with plated media,



which means there is less chance to damage them. (Let's face it, the oxide that most disks come with is nothing more than rust.) We then test the drives, pre-format

them, and install DOS 3.0 so that you're ready to begin transferring files. We even include DOS 3.0 documentation.

And they're 100 percent IBM compatible. The controller we send you for the XT is an upgraded version of the XT controller from the same company that makes the XT controller. In fact, the Express Systems controller is an improved controller which requires less power so that it is more reliable than any other standard controller.

We provide the power too.

If you want to upgrade your IBM PC, there just isn't any way around upgrading your power supply—if you want to have true XT or better capability. Some companies say that their hard disks don't require any increase in power—and they might be right. But don't add anything to your slois, because the minute you do, you'll need more power. That's the bad news.

The good news is that our power supplies are inexpensive. How's \$99.50 for an XT power supply? We mean a full 130 watts of power. The other good



Our 130 watt power will convert your PC to XT standards, and it's only \$99.50 with any tape drive or hard disk order.

certainly install it yourself. IBM has proved it with their instructions for self-installation that come with the new IBM PC AT.

## Express Systems Upgrade Kits

(Includes controller, software, and cable where appropriate)

|                                                                                                                                  |        |
|----------------------------------------------------------------------------------------------------------------------------------|--------|
| <b>IBM AT (model 99) to AT ExPlus™</b>                                                                                           |        |
| 1 half-high tape drive system                                                                                                    | \$995  |
| <b>IBM XT to XT ExPlus</b>                                                                                                       |        |
| 1 half-high floppy and 1 half-high tape drive system                                                                             | \$1095 |
| <b>IBM AT (model 68) to AT ExPlus</b>                                                                                            |        |
| 21 Megabyte upgrade                                                                                                              | \$1895 |
| 1 half-high 21 megabyte hard disk with half-high tape drive system                                                               |        |
| 31 Megabyte upgrade                                                                                                              | \$2195 |
| 1 half-high 31 megabyte hard disk with half-high tape drive system                                                               |        |
| <b>IBM PC to XT ExPlus</b>                                                                                                       |        |
| 2 half-high floppies, 1 half-high 10 megabyte hard disk with controller, 1 half-high tape drive system and 130 watt power supply | \$2095 |

news is that it's held in by only 4 screws. Express Systems' power supplies can be changed in 20 minutes, a small price in time for the peace of mind to convert your PC to an XT-capable machine and avoid the unsightly "wart-like" power supply add-ons that some companies insist you paste on the back of your PC.

### But from a mail order house?

We get tired of the snide remarks some people make about mail order houses. The comments are usually spread by distributors and retailers who are getting cut out of 15 and 35 percent margins, respectively. If we went through distribution—you'd have the privilege of paying for large glass windows, rugs, salesmen, etc.—but we'd also be selling this tape drive for \$3495.

We're not criticizing distributors and retailers. They perform a valuable service. But you don't need them if you know what you want. And you can

certainly install it yourself. IBM has proved it with their instructions for self-installation that come with the new IBM PC AT.

And speaking of IBM, the next time you hear anyone criticize mail order as a way to buy computer equipment, remind them that IBM is now in the mail order business.

### Warranty

We offer you a one year warranty on our hard disks—the same as IBM on the AT and 90 days on the tape drives. (It's all the manufacturer gives us.) If anything goes wrong with your tape or disk drive or hard disk, send it back in the box it came in. However, we have found that we can usually solve the problem over the phone. So call first for a return authorization number because we can't accept any returns without it.

### Immediate delivery

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| <b>Tape Subsystem</b>                                                                                                                                                  |        |
| Tape system, controller, power, supply, cable, and chassis                                                                                                             | \$1195 |
| <b>Internal Tape &amp; H.D. System</b>                                                                                                                                 |        |
| Tape & hard disk internal systems come complete with tape controller and hard disk controller, software, and cables. Hard disks are formatted and tested with DOS 3.0. |        |
| Tape drive & 10 MB H.D.                                                                                                                                                | \$1695 |
| Tape drive & 21 MB H.D.                                                                                                                                                | \$1895 |
| Tape drive & 31 MB H.D.                                                                                                                                                | \$2195 |
| <b>Hard disks Kits</b>                                                                                                                                                 |        |
| (includes Controller and cable)                                                                                                                                        |        |
| 10 megabyte hard disk*                                                                                                                                                 | \$695  |
| 21 megabyte hard disk*                                                                                                                                                 | \$995  |
| 31 megabyte hard disk*                                                                                                                                                 | \$1395 |
| *Subtract \$95 for IBM AT which does not require hard disk controller                                                                                                  |        |

|                          |       |
|--------------------------|-------|
| <b>Controllers</b>       |       |
| Hard disk controller     | \$195 |
| <b>Floppy Disk Drive</b> |       |
| Half high floppy disk    | \$129 |

|                                                                                 |         |
|---------------------------------------------------------------------------------|---------|
| <b>Power Supply</b>                                                             |         |
| 130 Watt XT replacement                                                         | \$99.50 |
| *Price valid only with purchase of tape drive or hard disk. Otherwise, \$149.95 |         |

|                                             |         |
|---------------------------------------------|---------|
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Your PC may not be able to think for itself, but expert systems let you equip it with the knowledge and intuition to emulate human thought processes.

# Artificial Expertise: INTELLIGENT SOFTWARE FOR PROBLEM SOLVING

Everyone knows computers can't think. But if you use your PC to run an expert system, it might seem to have a mind of its own. Expert-system programs absorb technical knowledge from human specialists, apply it to varied situations, and reach conclusions. They represent the first truly useful application of artificial intelligence—ordinarily based on mainframes—to be squeezed into a microcomputer.

In this issue, *PC Magazine* reviews seven programs: one, *Lightyear*, uses some expert-system techniques but is actually a





Expert systems are a direct outgrowth of nearly 30 years of mainframe-based study into artificial intelligence.

decision-support system; *Exsys* and *Expert-Ease* are affordable expert systems and are fairly easy to master; and four heavy-duty, top-of-the-line systems, *M.I. REVEAL*, *ES/P Advisor*, and *TIMM-PC*, produce complex and useful applications. We also explore PC versions of LISP and PROLOG, the two main languages used in AI research.

In many ways, the intense interest in the emergence of microcomputer expert systems this year parallels the fuss made over genetic engineering's commercial debut of Interferon, the anticancer drug, in the late seventies. The two technologies burst onto the marketplace after decades of fermentation in academic cellars, and the first vintage, in both cases, has been immature. But if you had badly needed the drug, you probably would have taken the first genetically engineered batch and tried to forget about its high cost and impurities; similarly, if you require automated expertise right now and can live with the high prices, lengthy inputting procedures, small "knowledge base" storage, and other problems found in this first generation of expert systems, it may not be wise to wait.

### Different Viewpoints

Expert systems are a direct outgrowth of nearly 30 years of mainframe-based study into artificial intelligence, an umbrella term that describes a group of technologies aimed at making computers imitate aspects of human thinking. What is human thinking? No one completely understands. Any four researchers you might select could have a shouting match on the subject. The first researcher might howl that the answer is found in the difference between divergent and convergent reasoning. Old-fashioned computers are good at divergent reasoning, which yields a lot of results from a small amount of data, such as in a payroll program; people are naturally adept at convergent reason-

ing, which yields few results from massive amounts of data, such as when a woman mulls a lifetime of romantic experience before answering her suitor's marriage proposal with a simple "yes."

The second researcher might roar that the key to human thinking is rules of thumb. Under this theory, you sift all input through a screen of basic rules that are often buried so deep in your mind you can't name them. The third might bellow that your mental architecture is the root of human intelligence: you simultaneously process different parts of a problem "in parallel," rather than shoving them all in single file through the bottleneck of a CPU in a computer.

And, the fourth researcher—probably the most accurate of the group—might whisper that all three definitions are correct, just as the three blind men are correct in saying that an elephant resembles a tree, a wall, and a rope. Artificial intelligence aims first to define and then to copy something that is profoundly mysterious, perhaps even impenetrable.

### A True Science

AI was not a true science until 1956, the year in which Marvin Minsky, now at the Massachusetts Institute of Technology (MIT), Claude Shannon, of Bell Laboratories, and other luminaries of information science met at a conference at Dartmouth College. John McCarthy, then assistant professor of mathematics at Dartmouth, coined the term *artificial intelligence* for the theme of the conference. The conference's high point was the unveiling of what some consider the first expert system, Logic Theorist. It processed nonnumerical symbols instead of crunching numbers and was able to prove several theorems in the *Principia Mathematica* of Alfred North Whitehead and Bertrand Russell. However, no magazine would publish the proof because it was thought up by a machine.

In the 1960s, other programs appeared that imitated human decision-making by using such fuzzy humanlike skills as educated guessing and inference drawing. One, Dendral, was developed in 1965 at Stanford University to help identify organic molecules from mass spectrograms and other data. The program has been refined hundreds of times and is still in use.

Approximately 50 mainframe-based expert systems are now in operation. The better-known systems include: Caduceus, which helps doctors diagnose bacterial infections; CATCH, which scans 250,000 photographs to assist New York City police in identifying criminal suspects; and Prospector, which sifts geological data to estimate the probability of a large ore deposit. Prospector illustrates the practical side of an expert system: it found a molybdenum deposit worth \$100 million.

### The Knowledge Base

The information flow of a modern mainframe expert system begins with the "knowledge base," which is filled with simple "if then" facts, such as, "If the patient limps, it may be a sprained ankle," and with such general rules as, "if it is a sprained ankle, apply dressing and advise rest." Expert-system designers found that dredging these general rules from the subconscious of human experts is a huge challenge. Consequently, they have developed knowledge acquisition systems to help experts articulate their gut feelings in a form that is acceptable to an expert-system's architecture.

The heart of the system is an "inference engine," a series of commands that channels information in complex loops. In addition, the system has a "workspace" that holds both a description of the immediate problem and a status report on the program's efforts to solve it and a natural language interface that translates questions and answers for the user. The inference engine orchestrates a dialogue between

you, the workspace, and the knowledge base—it is this multidirectional flow that many researchers say distinguishes AI systems from typical software programs. When confronted by a problem, such as insufficient data, the flow does not stop. The system asks more questions, draws more tenuous inferences from the knowledge base, and reaches conclusions that are phrased the way a professional would when hedging his or her bets: "My preferred therapy is as follows. . ."

The common language of many mainframe AI programs is LISP (list processor), a language invented over 20 years ago that is now "spoken" fluently by about 3,000 programmers in the United States. LISP is adept at linkages. When a symbol is lodged in a computer memory, LISP ensures that the symbol is not an isolated chunk but is intimately and logically linked with related symbols like a knot in a net. LISP is also flexible; it lets the "knots" untie themselves and weave new, more-efficient configurations that are based on experience. Essentially, it can learn. The Japanese are using the other main AI language, PROLOG, in their intensive "fifth generation" computer project.

### A Thinking PC

Until now, average personal computer users have been like kids with their noses pressed against the window of a candy store, or in this case, of an MIT, Stanford, or Carnegie-Mellon AI research lab. But just as designers downsized the mainframe computer to fit the average user's lifestyle and budget, they have also restructured mainframe expert-system programs to fit the microcomputer. The programs that are reviewed in this issue are only the first trickle; a flood of more specialized and powerful expert systems for PCs is expected over the next 5 years.

Predictably, denizens of high-powered research laboratories are unimpressed by



Designers of expert systems have found that dredging general rules from the subconscious of human experts is a huge challenge.

## EXPERT SYSTEMS

**While** some tasks may forever lie beyond the reach of expert systems, the programs are growing more sophisticated at a truly astounding pace.



this first wave of miniature imitations of their mainframe expert systems. "There is no hard-and-fast definition of an expert system, and it has become one of the most abused terms of the modern era," says James Meehan, director of research at Cognitive Systems, an AI firm in New Haven, Connecticut. "Anybody who's got a working program is suddenly calling it an expert system . . . when, in fact, what they have is a good, old-fashioned decision-tree program." Meehan says that along with sophisticated information flows and linkages, a true expert system should have natural language capability. "You've got to be able to have meaningful dialogue with it. The expertise should be available to anybody who knows English," he adds.

But, just as predictably, the marketers of expert systems for PCs say multidirectional logic loops and massive natural language generators simply are not needed. They say the true definition of an expert system should be based on whether it provides expertise and not on how the information flows internally. Jeff Milman, president of the New York-based Expert Systems, Inc., a distributor of *Expert-Ease*, says, "The reason *Expert-Ease* fits on a microcomputer is that it is a complete departure from all of the [mainframe] expert-system work, at least that I know about, that's produced in the United States." The program reasons through induction, that is, from one specific example to many general rules; while Dendral, Caduceus, and other American mainframe-based systems reason through deduction—going from hundreds of general rules to a specific example. Milman acknowledges that *Expert-Ease* is a one-way, decision-tree program, but he says that up to 19 matrixes can be chained together so that "you can create a large system that is very useful in solving real-world problems." A built-in word processor in *Expert-Ease* takes the place of a nat-

ural language generator by allowing you to write question-and-answer terminology. Customers use the program to generate systems that dispense advice on everything from oil refinery design to hazardous waste disposal.

### Real-World Problems

Expert systems, even small-capacity ones, are good at such tasks as oil refinery design because an oil refinery is a well-defined unit with a specific task. On the other hand, a novelist wrestling with writer's block would find it difficult to build the knowledge base of an expert system that would answer the question, "What should I write in the next chapter?"

But, while some tasks may forever lie beyond the reach of expert systems, the programs are growing more sophisticated at a truly astounding pace. When, as in the case of these systems, the very first incarnation of a new technology has widespread practical value, the second incarnation could easily pervade the industrial world; the third and fourth waves could change society as a whole. With the clay of AI—LISP and PROLOG—now adapted for sculpting in microcomputers, you can soon expect a wide variety of more-powerful expert systems, natural language generators, and even highly adaptable robot controllers to soon come marching out of venture-capital research labs and basement workshops.

Where will it end? Robert Jastrow, professor of Astronomy and Geology at Columbia College, says that someday researchers will discover that intelligence can be as equally at home inside metal and plastic as it is in its current "shell of bone." If he is right, the sort of personality this silicon-based intelligence may assume is anyone's guess. We can only hope that it feels some compassion for those who nursed it through its infancy and tolerated its fussiness, expense, and occasional tendency to bite. ■

EXSYS's low-cost run-time package and innovative use of probability variables make it a practical tool for developing expert applications.

# An Affordable Adviser

**A**t the affordable end of the expert system spectrum is the *EXSYS Expert System Development Package*, a capable program that you can use to create expert systems containing many rules, conditions, notations, and statistical capabilities. The \$295 *EXSYS* package includes an editor for creating the rules and a "run-time" program that can run, but not create, applications programs. This run-time package is invaluable for developers who want to distribute applications programs without being forced to buy the entire package for each application copy.

All expert systems created with *EXSYS* look the same. All *EXSYS* knowledge bases use straight text presentations that ask multiple-choice questions. But you can add comments and send users' messages at the beginning and end, and the program makes good use of color if your system has it. *EXSYS* offsets its lack of graphics and input flexibility with its low

price and uncomplicated structure.

You need a PC with 256K RAM to make full use of *EXSYS*. This configuration is enough to create a knowledge base with about 700 rules per 64K of memory over 192K of RAM. The entire knowledge base must fit into RAM. But it is possible, to use the run-time module to run knowledge bases in less memory than the editor needs to create them. The program is not copy protected and can be used on a hard or RAM-disk.

The *EXSYS* package's editing module creates the rules, conditions, and alternatives that make up an expert system. It has features designed to help you keep track of the flow of logic and options in the system. It prompts you to provide the data it needs to set up an application (see Figure 1). The program's use of color (if available) and



screen design help to clearly display the established rules and conditions.

During application development, the screen is divided into three sections (see Figure 2). The left side of the screen displays the IF, AND, and THEN conditions. The right side of the screen shows alternatives and conditions that can be recalled, scrolled, expanded, and edited. The bottom of the screen displays prompts indicating the commands available at the particular functional level you are in.

The editing program lets you easily review and change anything in the knowledge base. When I was learning to use the program, I had to backtrack and edit many times; thus, the review and revise functions were very welcome. The editing module links to the run-time module, so you can easily try out your changes as you make them. The editing module also lets

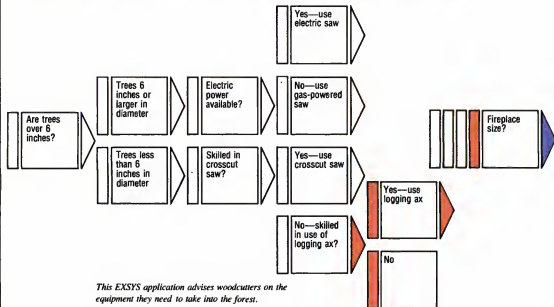
you print the contents of the knowledge base so you can make changes based on what you see on paper.

### Planning to Go

To test EXSYS, I created an expert system to help select equipment for a wood-cutting expedition. Wood-cutting expedition planning software may not be the most exciting application, but it offers a simple, practical, and easy-to-understand example of an expert system.

My house has a wood stove for supplemental heating, so I have gained a good deal of experience planning expeditions into the forests of Virginia to chop down trees, split the logs, and transport the wood. I was curious to see how well EXSYS could capture my expertise to make things easier for novices. For example, only after several expeditions did I

**EXSYS's**  
editing program  
lets you easily  
review and  
change anything  
in the knowl-  
edge base. The  
editing module  
links up to the  
run-time mod-  
ule, so you  
can try out  
your changes as  
you make them.



*This EXSYS application advises woodcutters on the equipment they need to take into the forest.*



learn that taking too much equipment can be as much of a problem as not taking enough.

To create the expert system, I started by listing all of the possible equipment you might take into the woods. I entered the list into the program as a list of alternatives. I had seven major items on my list, including two kinds of chain saws, two kinds of axes, ropes, and splitting wedges.

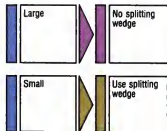
At this point, according to experts on expert system design, I should have diagrammed on paper all of the conditions leading to the selection of each piece of equipment. Each diagram should describe all of the alternatives and the outcome of the selection of each alternative. I did make a couple of diagrams, but I soon found that it was just as easy to use *EXSYS*'s capabilities and create the logic trails on the computer. After I used the

sample programs to gain some experience, it took me only an hour of steady work (with some trial and error) to create an expedition planning system containing ten rules with at least two conditions to each rule.

A rule might state: If you intend to cut trees over 6 inches in diameter (condition 1) AND electrical power is available at the cutting site (condition 2), THEN take an electrically powered chain saw (conclusion). *EXSYS* allows you to add notes and explanations telling users why particular conclusions were drawn. (In this case, I felt that trees over 6 inches in diameter call for the use of a chain saw, and I prefer electric chain saws to gas-powered models when electric power is available.)

To use the expert-system application I created on *EXSYS*, the user answers a series of questions with alternatives based

**It took**  
me only an hour  
of steady work  
to create a  
wood-cutting  
expedition  
planning system  
containing ten  
rules with at  
least two  
conditions to  
each rule.



**EXSYS** can consider probabilities, a realistic approach that many expert-system programs are unable to match.

on the size of the trees and, if the trees are over a certain size, the availability of electric power. Figure 3 shows part of an inquiry session with this application. A response indicating that smaller trees are the target moves the program into a logic chain leading to the selection of an axe or cross-cut saw, instead of a chain saw. At any point, the user can ask to see the rule upon which the program is basing it's questions or answers (see Figure 4).

### Setting Probabilities

EXSYS allows you to specify the probability that a conclusion is correct. You can set the probabilities within an application according to one of three sets of conditions. The first simple set of conditions lets you set all choices to either a 0 or 1 value. This means that there is no probability involved, and the first rule that has all of its IF conditions met draws the conclusion stated in its THEN section.

The second set of conditions allows you to set choices on a value scale from 0 to 10. In this system, which is the one most often used, the values 0 and 10 permanently decide the conclusion. These are the equivalent of absolutely yes or no. The values of 1 to 9 represent degrees of confidence ranging from probably not to prob-

ably so. These values are averaged over all of the rules to select a final choice.

In some situations, you might give EXSYS a string of answers that could eventually lead toward two different conclusions. Some programs might treat this as a race: the first string of answers to reach a conclusion wins. EXSYS continues to ask questions to determine if the conditions could possibly lead to another conclusion. If two conclusions are possible, the program evaluates the probabilities assigned to each string of rules and selects the most probable. You can also ask to see all of the evaluated conclusions to make a personal determination.

While programming an application,

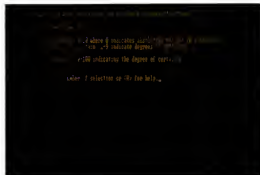


### EXSYS Expert System Development Package

Exsys, Inc.  
P.O. Box 75158, Contract Sta. 14  
Albuquerque, NM 87194  
(505) 836-6676  
List Price: \$295, \$10 for demonstration disk.

**Requirements:** 256K RAM, one disk drive.

CIRCLE 750 ON READER SERVICE CARD



**Figure 1:** When you begin an application, EXSYS questions you about the structure of the system you wish to create.



**Figure 2:** During rule development—the heart of an EXSYS application—the screen is divided into three sections.

you can choose to use an even more complex system that assigns values from 0 to 100. These values can be combined as a simple average, computed as dependent variables, or computed as independent variables. If the selection of a conclusion depends upon the truth of a combination of linked conditions (dependent variable), then the probability of this conclusion being appropriate will vary with the particular conditions selected. The probabilities of all selected conditions are multiplied together to determine the probability that a conclusion is right. The program compares this number with the values reached for other conclusions and selects the most probable one. This kind of decision-making power can help make you make choices involving very complex variables. *EXSYS* uses a similar formula to examine the probability that a conclusion is true when multiple independent conclusions are selected.

*EXSYS* can consider probabilities, a realistic approach that many expert-system programs are unable to match. They have no provision for reaching two different conclusions from two identical sets of conditions, but the real world isn't always so clear cut. The ability to combine probabilities is an advanced feature that makes

*EXSYS* more practical for some applications than more rigid programs.

*EXSYS* suffers from a weak manual. Considering the power of the program, the 62-page double-spaced manual's lack of a tutorial, index, and glossary is hard to understand. The manual for Version 2.0 does include a section on planning expert-system applications, but I still had to endure much trial-and-error learning in order to become more comfortable with the program.

On the positive side, the *EXSYS* package includes several sample applications and a good on-line help facility. With the manual, the on-line help, the examples, and a bit of perseverance, you can learn to use the program in a couple of hours. I would, however, suggest you scribble notes in the manual as you go along.

*EXSYS*'s low price and modest hardware demands make it an excellent choice for those who want to experiment with expert systems. At the same time, its runtime package and liberal licensing arrangements make it desirable for programmers who want to distribute many copies of the applications program they create. This combination makes *EXSYS* a flexible and powerful program to help you develop applications in many different areas. ■

## EXSYS

suffers from a weak manual. Considering the power of the program, the 62-page double-spaced manual's lack of a tutorial, index, and glossary is hard to understand.



Figure 3: During an inquiry session with an *EXSYS* application, the user responds to multiple-choice questions.



Figure 4: The user can, at any time, ask to view the rule upon which the program is basing its questions or answers.

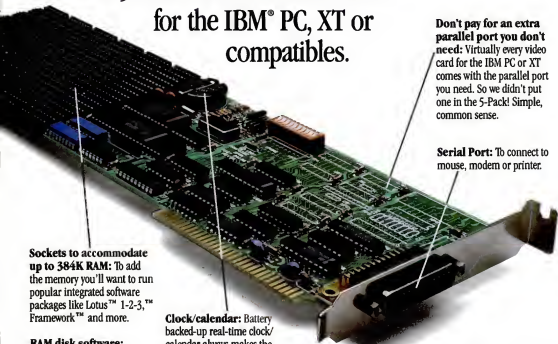
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# PARADISE

*You can measure it.*

Expert-Ease is an inductive logic program that can even give experts new insight into the complex situations they deal with.

# Expert-Ease Makes Its Own Rules

Spreadsheets give you an edge in solving problems. Even experts often find that arranging a large amount of data in rows and columns helps structure their thinking and often leads to new insights. A popular expert system, *Expert-Ease*, has such an edge. While some expert systems use menus or segment the screen into IF and THEN areas, *Expert-Ease* uses a spreadsheet format to structure its examples and attributes, or knowledge base, from which the program draws conclusions.

The format lets you build an expert system in about the same time as you can build a complex financial spreadsheet using 1-2-3 or *Multiplan*.

*Expert-Ease* was developed in the United Kingdom by Donald Michie at Edinburgh University. Until late 1984, it was marketed by Export Software International, Ltd., for a retail price of \$2,000.

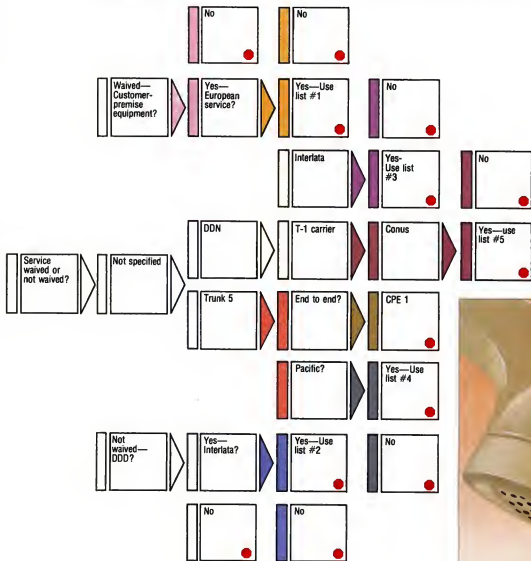
In 1984, Human Edge Software in Palo Alto, California, acquired the rights to produce *Expert-Ease* in the United States.

Now Human Edge manufactures *Expert-Ease* and distributes it for \$695 through traditional retail outlets; it also sells the program direct for \$695 plus \$5 for shipping. Jim Chapman, executive vice president of Human Edge, says that the program has remained essentially the same but the manual and packaging have been improved. Human Edge also intends to market expert systems written with *Expert-Ease* on such topics as credit approval procedures and commercial shipping methods.

At about the same time another company, Expert Systems Inc., in New York City, was equally quick to jump on the bandwagon. Expert Systems has become a distributor for both the Scottish-made product—which will continue to be made in the United Kingdom—and the Ameri-



# EXPERT-EASE



*This Expert-Ease application helps users choose among various long-distance telephone services. Users need some background about the services before they can use the application.*



can version made by Human Edge Software. Jeffrey Milman, head of Expert Systems, plans to market both versions for \$675 plus a \$20 shipping charge and, for \$200, offers a full-function, limited-capacity demonstration disk that will be fully credited on trade-in for the \$675 program. He promises 24-hour-a-day telephone support and will advise users on operating the software and constructing an expert system.

*Expert-Ease* has acquired a reputation as the most popular expert system. Several magazine articles have called it *the* benchmark program for expert systems work done on microcomputers. With its repricing and the new emphasis on retail mar-

keting, *Expert-Ease's* position as a standard is likely to be improved.

### Perfectly Logical

*Expert-Ease* is an inductive logic program that, in addition to letting nonexperts draw on someone else's expertise, can give the experts themselves some insight into the problems they work with and the conditions affecting them. You don't have to write the rules that the program uses to make decisions about the data you give it—*Expert-Ease* does that for you. All you have to do is structure the material so that the program can infer a logic table from the examples.

In simple applications, the rules that apply to a decision will probably be obvious to you as you enter the examples. But in very complex situations, they may not be. Often factors that you think are important are not. When *Expert-Ease* derives its rules, it ignores factors that are not really important in reaching a conclusion. In this way, it does more than simply pass your expertise on to the people who run the knowledge base you create—it helps you understand the problem better yourself, even when you are the expert.

The ability to infer rules from examples can also be useful to researchers who don't know the logic behind certain conditions or events but suspect that the events may be related and that the relationship is a consistent one. If you had no knowledge of the theory of gravity or the moon's effect on the tides, you could feed *Expert-Ease* such data as the time of day, the sacrifice you made to the sea god Neptune, season of the year, position of the moon, constellations in the sky, and level of the tide. *Expert-Ease* would examine the data and formulate a rule linking the conditions (for example, position of the moon) that seemed to affect the dependent variable (tide height).

Medical doctors, archeologists, astronomers, and many other professionals can

**When**  
*Expert-Ease*  
derives its  
rules, it  
ignores factors  
that are not  
really  
important in  
reaching a  
conclusion.







System are surprised when it makes their disk drives sound like they're grinding corn, but that's part of the price p-System pays for trying to be a universal operating system.

After a minute or so of noisily grinding and crunching, the *Expert-Ease* file menu screen appears. This screen has a menu of commands and an annotated listing of the files. (*Expert-Ease* comes with several sample knowledge bases designed to illustrate its features; see Figure 1.) Help screens are available at almost all levels in *Expert-Ease*. The explanations are useful, and requests for help are met quickly.

### A Complex Application

I used *Expert-Ease* to build an application directly related to my own work at Telco, where I have responsibility for ordering millions of dollars of commercial telephone services a year for the federal government. Formerly, the people doing this work needed only a knowledge of telephone technology and a familiarity with business practices to be effective. However, the divestiture of AT&T and the restructuring of the telephone industry by the FCC have created a situation where technical skills and a knowledge of business practices aren't enough. An account

manager now needs to have the acumen of a lawyer just to determine where to send orders for service. *Expert-Ease* can serve a valuable function by training a large number of people in the complex rules and regulations that now enmesh the telephone system.

The knowledge base I built contains a dozen examples of different types of telephone services ordered within different geographic and legal boundaries. Each example contains a type of service (such as direct distance dialing), a category (such as continental United States), and a list of potential suppliers that should be solicited for bids. Account managers who are already familiar with the services in question can use the system to help them decide more quickly where service solicitations should be sent. When similar situations occur repeatedly, they would probably learn the best choices through experience, but the computerized system would still be available as a backup.

I constructed a knowledge base by creating columns to represent the three independent factors I allowed for each example and the possible decisions that could be made, then listed the various items under the appropriate columns. The items listed include digital data network services,

**Help**  
screens are available at almost all levels in *Expert-Ease*. The explanations are useful, and requests for help are met quickly.



Figure 3: Rules that *Expert-Ease* has inferred from the examples in the Telco knowledge base.

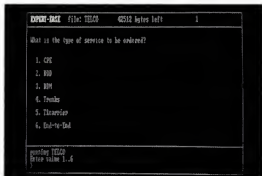


Figure 4: In the query part of the program, *Expert-Ease* asks the user short multiple-choice questions.

trunk circuits to go between telephone switches, interstate and intrastate circuits, and many others. *Expert-Ease* asks you to list all possible items or numeric values that might appear in each category of factors and in the list of decisions. However, you need enter each possible item or numeric value only once.

After the items or values are listed, you move to a second *Expert-Ease* screen that allows you to enter the examples (see Figure 2). Since all the item names or numeric values of the factors and results are already in the program, you can enter the examples quickly and save time and effort by typing just one or two letters of the item name or numeric value you want. The program fills in the rest.

One feature I appreciate enables the person constructing the knowledge base to add text to each item name and category with additional information for those using the program. Since the spreadsheet format limits the number of characters you can use in an entry, the ability to annotate entries makes the final product more understandable, personalized, and pleasant to use.

After you enter the examples, *Expert-Ease* will construct the logic table it uses to reach its conclusions. This may take several minutes if there are many examples,

but you don't have to do it again unless you change the examples. Figure 3 shows the rules *Expert-Ease* inferred from my examples.

Once the examples are entered and the rules that govern them discerned, the query part of the program—where it asks you short, multiple-choice questions—can be run (see Figure 4). Answers to these questions can be drawn from several lists of alternatives; the alternatives themselves are made up of the values listed in the attribute section. The program asks questions until all its logic paths have been satisfied, then presents its final answer (see Figure 5). The user can ask to see the logic table to trace how an answer was decided, but the program cannot supply any further explanations about how the conclusions were reached.

On the whole, using *Expert-Ease* is simple and nonthreatening—in fact, its only drawback may be that it is too simple. There isn't any way for experienced users to shortcut the process: You have to wade through all the questions, even if you know most of the answers. In this case, the memory limitation of *Expert-Ease* may be an advantage, because smaller knowledge bases give experienced users the ability to pick and choose the sets of questions they want to answer.

### Expert Documentation

The manual supplied with the program is well illustrated and easy to follow. It includes a tutorial with references to more complete explanations of specific actions. The examples are also cross referenced to the sample applications on the *Expert-Ease* disk.

*Expert-Ease* is a mature and valuable piece of software that deserves a solid place in the microcomputer software market. The recent reduction in price makes it competitive and opens up new opportunities for commercial developers and people who need an economical expert-system construction package. ■

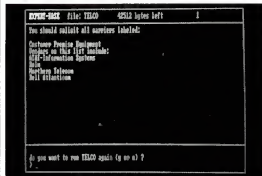


Figure 5: When all its logic paths have been satisfied, *Expert-Ease* presents its final answer.

REVEAL, an expert system aimed at the business market, has a spreadsheet-like format that will look familiar to its targeted users.

# Revealing Business Solutions

While it may seem that traditional programs and expert systems are worlds apart, the two approaches need not be mutually exclusive. One product that attempts to combine the best features of both categories is *REVEAL*, marketed by the Knowledge Engineering Division of InfoTym, a subsidiary of McDonnell Douglas. *REVEAL* not only has many typical expert-system features (knowledge-based rules and fuzzy logic, for example), but also incorporates a wide range of traditional programming facilities.

The *REVEAL* environment offers programming constructs such as IF, ELSE, DO, and REPEAT, as well as special functions (for example, compound interest, mortgage payment calculation, and depreciation) that can be used for developing business decision-support applications. Moreover, *REVEAL* is also equipped with data management and report generation facilities, as well as the

ability to interact with many external data files simultaneously.

Until quite recently, all this capability was of rather limited interest to users of personal computers, since *REVEAL* only operated on IBM 370 mainframes under VM/CMS or on Digital VAX systems under VMS. The IBM mainframe version is priced at about \$50,000, while the minicomputer versions start at around \$35,000.

Now there is a version of *REVEAL* for the IBM PC-XT, for \$4,500, which includes a mandatory 1-week training course. Naturally, the XT version is somewhat slower than the heavyweight models of the system, and it does require a full 640K RAM as well as an 8087 math coprocessor.

Instead of targeting the usual line-up of



**Reveal's** design is based on the premise that you should be able to build your own inference procedures and tailor them to individual applications as you see fit.

expert-system applications (such as fault-finding or medical diagnosis), InfoTym has tried a different approach. The company appears to be more interested in seeing *REVEAL* put to work in the corporate environment. Many of the product demonstrations focus on traditional financial applications—budgeting, forecasting, marketing, and project evaluation.

One reason that *REVEAL* is better-suited for the financial world than many other expert systems is because the system was developed in FORTRAN. PROLOG and LISP, the preferred AI languages, tend to excel at processing symbolic not mathematical, information.

#### Development Environment

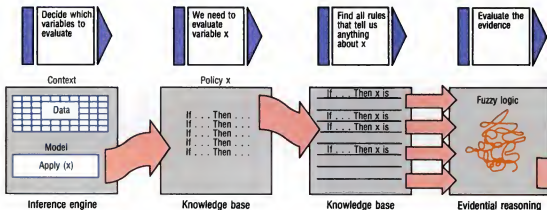
The *REVEAL* development environment consists of three major components: a table or matrix of data, a program model that describes the relationships among the matrix rows and columns, and, optionally, a "policy" program that can contain any relevant knowledge-based rules and can be called by the program model. You'll also

have to set up variables and constants and define so-called "qualifiers," a major component of the *REVEAL* environment.

All these features, when combined, are called the *REVEAL* "context." In viewing *REVEAL* as an expert-system environment, you can also say that the program model is equivalent to an inference engine and the policy program is the knowledge base.

Allowing you to create your own inference engine procedures in the form of models is quite a departure from the norm. Most other expert-system products are hard-coded inference engine mechanisms to which you hook your own knowledge base.

*REVEAL*'s design, however, is based on the premise that you should be able to build your own inference procedures and tailor them to individual applications as you see fit. Though not a bad idea, it can make program development into more of a job for the skilled programmer than a tool available for use by the novice.



*REVEAL's method of evaluating data and reaching conclusions is very different from the approaches of most other expert systems. This logic trail illustrates REVEAL's inference procedures more accurately than a decision tree could.*

### A Simple Model

Suppose you want to set up a simple table to help you set the price of a product, taking into consideration manufacturing costs and what the opposition is charging for a competing product. First, you have to decide what categories of data you will be dealing with and then create a *REVEAL* table to hold that data (the rows are called series, and the columns are called terms). In Figure 1, you see a table in which the series and terms have already been named. The table was created by entering the following command:

TABLE T1 T6 S1 S7

at the *MODE>* prompt. The labels were entered with the commands *NAMES* (for

the series) and *HEAD* (for the terms). Data was entered into the cells of the table with the *ENTER* command a row at a time. Although the table resembles a spreadsheet, it is not, and you are not allowed to roam about it freely.

So far, all you've done is give *REVEAL* the raw data; you haven't said what to do with it yet. You enter the first three rows—volume, unit cost, and fixed cost—yourself, so no calculations have to be performed.

However, the total cost, price, and revenue entries will have to be generated by formulas. You enter the last row, opposition price, manually.

Unlike with a spreadsheet, when you develop a model with *REVEAL*, you have



This is the most probable value of x

Value of x

the full facilities of a true programming language at your disposal. You can create conventional algorithmic routines using procedural statements and standard arithmetic operations.

In order to produce the total cost and revenue results, you start up the REVEAL editor. REVEAL's editor is primarily line oriented; therefore, each model line is identified by a unique number (the exclamation mark allows you to enter comments into the model space). You have a wide range of text-editing commands at your disposal. Although using REVEAL's editor did remind me of the "old days" of working with a VAX line editor, I found it

relatively easy to get along with.

If you enter some information into your table and then compile the model, you will find that the correct revenue values have been entered on the table. Still, you haven't added any kind of intelligence or knowledge to the pricing program—it is merely working as any other high-level program might. This is where the aptly named concept "fuzzy logic" comes into play.

### A Little Fuzzy

Conventional programs tend to be more useful in applications that require manipulation of precise data. The REVEAL system, on the other hand, is designed to deal with a more human world in which data need not be manipulated so precisely and in which judgment and evaluation can be only approximate. Theoretically, therefore, by employing fuzzy logic, the program has a much greater chance of accurately following your perception of the conditions around you.

REVEAL's application of fuzzy, or

DEMONSTRATION REVEAL TABLE

|            | JAN    | FEB    | MAR    | APR    | MAY    | JUN    |
|------------|--------|--------|--------|--------|--------|--------|
| VOLUME     | 100.00 | 200.00 | 200.00 | 150.00 | 200.00 | 250.00 |
| UNIT COST  | 3.00   | 3.00   | 3.50   | 4.00   | 3.50   | 5.00   |
| FIXED COST | 200.00 | 200.00 | 200.00 | 400.00 | 400.00 | 400.00 |
| TOTAL COST | .00    | .00    | .00    | .00    | .00    | .00    |
| PRICE      | .00    | .00    | .00    | .00    | .00    | .00    |
| REVENUE    | .00    | .00    | .00    | .00    | .00    | .00    |
| OPP. PRICE | 6.00   | 6.00   | 7.00   | 8.00   | 8.00   | 6.00   |

Figure 1: An example of a REVEAL matrix plotting various pricing factors over a 6-month period.

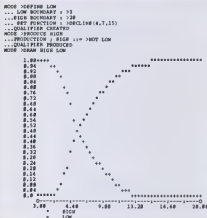


Figure 2: A graphic plot of the high and low "qualifier" boundaries that help REVEAL form a policy formula for calculating price.

```

1 * THIS IS A DEMONSTRATION POLICY FOR THE PRICING MODEL
2 *
3 1 OUR PRICE SHOULD BE LOW
4 1 OUR PRICE SHOULD BE ABOUT 2 * UNIT COST
5 1 IF OPP. PRICE IS NOT VERY HIGH THEN PRICE SHOULD BE NEAR OPP. PRICE

```

Figure 3: A program to create a demonstration pricing policy with the REVEAL editor.

DEMONSTRATION REVEAL TABLE

|            | JAN    | FEB      | MAR    | APR      | MAY      | JUN      |
|------------|--------|----------|--------|----------|----------|----------|
| VOLUME     | 100.00 | 200.00   | 200.00 | 150.00   | 200.00   | 250.00   |
| UNIT COST  | 3.00   | 3.00     | 3.50   | 4.00     | 3.50     | 5.00     |
| FIXED COST | 200.00 | 200.00   | 200.00 | 400.00   | 400.00   | 400.00   |
| TOTAL COST | 500.00 | 800.00   | 900.00 | 1,000.00 | 1,100.00 | 1,650.00 |
| PRICE      | 5.00   | 5.00     | 4.91   | 7.27     | 6.25     | 6.00     |
| REVENUE    | 500.00 | 1,000.00 | 982.00 | 1,190.50 | 1,250.00 | 1,500.00 |
| OPP. PRICE | 6.00   | 6.00     | 7.00   | 8.00     | 8.00     | 6.00     |

Figure 4: The matrix from Figure 1 with the missing price values added in by REVEAL.

approximate, reasoning relies on linguistic variables, qualifiers and hedges, and "noise" words. *Unit cost* and *volume* are examples of linguistic variables. Words like *low*, *high*, or *reasonable* are qualifiers, and *very*, *quite*, and *about* are hedges that can be used with qualifiers. Noise words are simply such phrases as *should be* or *our* that improve the readability of policy statements but do not affect their logical meanings.

To change the simple demonstration program into something that can monitor the product's price and change it according to the opposition's price fluctuations, you must first define two new qualifiers in a vocabulary file.

A vocabulary file contains all the names and definitions of qualifiers, hedges, and noise words that can be used in a particular application. You can create multiple vocabularies, each with a specific name.

Say you want to include a policy statement that says, "Our product price should be low, and our price should be about twice our unit cost. On the other hand, if the opposition's price is not too high, then our price should be near its price." *REVEAL* will allow you to enter statements pretty much in plain English like this policy statement, but first, you must quantitatively define *high* and *low* for the program.

### Defining Qualifiers

At the *MODE>* prompt, you enter *DEFINE HIGH* or *DEFINE LOW*, and *REVEAL* asks for a low boundary, a high boundary, and a "set" function. The low boundary is the point at which *REVEAL* will start plotting the truth value of the qualifier and the high boundary is the point at which the system will stop plotting the truth value. The set function can take five forms. *DECLINE* and *GROW* are two examples. If you look at Figure 2, you can see how *REVEAL* can create and graphi-

cally represent the high and low qualifier boundaries.

### The REVEAL Policy

After defining both the high and low qualifiers you create a *REVEAL* policy. To do this, you enter

#### POLICY PRICING

at the *MODE>* prompt. *REVEAL* responds to this line of code by switching into the editor mode again, only this time the statements you enter will be held separately from the model statements that you keyed in earlier. You then type the lines shown in Figure 3.

The final step is to re-enter the model you created and insert the line

```
apply ('PRICING')
```

before the total cost and revenue formulas. This line directs *REVEAL* to work out the price of the product by applying the correct rule or rules in the pricing policy. Once it has accomplished this task, it is then able to generate the missing values in the model (see Figure 4).

### Stock Market Advisor

*REVEAL*'s demonstration stock market advisor, created by Jack Geer, a business consultant with the *REVEAL* group, is an example of the program's capacity to operate full-featured applications. One of the

**Reveal**  
is designed to deal with a human world in which data need not be manipulated precisely and in which evaluation can be approximate.



### REVEAL

McDonnell Douglas  
Knowledge Engineering  
Products Division  
20705 Valley Green Dr.  
Cupertino, CA 95014  
(408) 446-7406

List Price: \$4500

Requires: 640K RAM, hard disk drive;  
8087 coprocessor recommended.

CIRCLE 727 ON READER SERVICE CARD

## REVEAL

### Info-Tym

has put REVEAL in a rather unique marketing position: It straddles the fence between traditional decision-support systems and advanced AI endeavors.

program's policy procedures and a sample listing of a session with the program are given in Figures 5 and 6, respectively. This particular application uses multiple policies and a detailed set of modeling statements in order to advise you on portfolio investment. Don't start calling your broker yet, however; it is still a prototype program.

Although there is no automatic explanation facility built into the REVEAL system, Geer's demonstration program is able to answer a "why" query by listing the relevant policy rules.

### Marketing Strategy

REVEAL's price and marketing approach assures that it will be treated more like a conventional mini/mainframe product than an "AI product for the masses." Certainly, REVEAL is unlikely to cause the already overburdened corporate MIS manager to break out in yet another cold sweat.

REVEAL looks and feels like an MIS product, and it is capable of running on MIS-type machines. You can even link

XTs up to a mainframe that supports REVEAL and interact with it on a shared basis. And then there's the important capability that links REVEAL to conventional database files already stored in the corporate mainframe.

InfoTym has placed REVEAL in a rather unique and enviable position in the expert-systems marketplace: It straddles the fence between traditional decision-support systems and advanced AI (artificial intelligence) endeavors. Its user interface could do with a little more work, but it's not a material disadvantage; since it's not really designed for those who shop their local computer store for software, the interface is not really a problem.

### Conclusion

If you want to become familiar with expert systems work and yet not cast off from the mainstream of business computing, REVEAL may be just the system that you are looking for. If you are an MIS manager, it will be a powerful and unorthodox new way to keep your PC users happy.

```

FINANCIAL FORECASTING ADVISOR

MODE NEWT.DOW

1: i policy to determine bull or bear market
2:
3: if v.prise is an prime.decrease and v.inflation is
 an inflation.decrease then buy.dow is indicated
4:
5: if v.nl is near zero and v.inflation is near zero
 then buy.dow is indicated
6:
7:
8:
9: if v.sentiment is an sentiment.decrease then sell.dow is
 indicated
10: if v.sentiment is an sentiment.increase then buy.dow is indicated
11:
12: if v.disc.rate is an disc.decrease then rally is indicated
13: if v.disc.rate is an disc.increase then slump is indicated

```

Figure 5: A sample policy-forming procedure from REVEAL's stock market demo with rules for buying and selling.

```

...What term do you wish to execute over ? >5

FINANCIAL FORECASTING DEMONSTRATOR

PLEASE ENTER DATA FOR THE SET FINANCIAL VARIABLES
inflation 514.5
prime 511.25
gold 51337
dow Jones 51274
IBM close 51223
Bank.America close 5116
enter perception of economy in a scale between
 0 and 100 if indicators point to growth 5178
fa.raus yen 51245
on the basis of last period's values
the following recommendations can be made

DOW is likely to increase, so consider buying stock
is indicated with confidence 95.89

Indicators are showing that that gold should
rise in a few months gold futures confidence 100.00

inflation is falling and if hard assets have lost value
the last two years then buy oil, land etc 51.88

do you need further analysis? >

```

Figure 6: A sample analysis session from REVEAL's stock market demo showing the major financial assumptions and conclusions.



ES/P Advisor's complexity makes its useful features, such as a PROLOG interface, accessible mainly to developers well versed in programming.

# Raw Power For Problem Solving

**D**espite its name, there is nothing extrasensory about *ES/P Advisor*—or about any other expert system for that matter. The technology is still in its infancy, and I am aware of no plans for artificial intelligence software that can literally read your mind. However, of all the knowledge-based software development systems available for the PC, *ES/P Advisor* is the only one so far that can handle applications that guide a user step by step through a complete process, giving all essential information at each stage.

Usually the expert knowledge and advice available from an expert-system consultation shell come only at the end of a question-and-answer session prior to which users describe the problem they are trying to solve. But *ES/P Advisor*'s "text animation" feature allows you to produce a script that gives the user all the information needed to perform a detailed operation involving technical skill and knowledge.

*ES/P Advisor* is a PROLOG-based

expert-system shell developed by Expert Systems International, the firm that also sells PROLOG-1, the PROLOG version for the IBM PC in which both this system and Teknowledge's *M.I* system were developed (see "*M.I* Makes A Direct Hit" in this issue).

For this reason, *ES/P Advisor* both mirrors many of the features of the PROLOG language and has an interface to the language for the PROLOG programmer. This interface makes it one of the very few

expert-system development packages with an open-ended architecture, in the sense that a qualified programmer can use a full-fledged programming language to add to the system features it currently lacks.

The knowledge representation scheme is the single most important factor in determining how powerful an application you

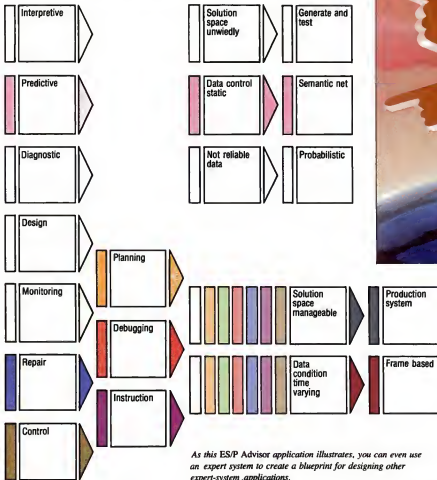


can build with an expert system. The Knowledge Representation Language (KRL) used with *ES/P Advisor* is one of the more versatile and sophisticated languages currently available for the PC. KRL supports both numeric and string variables of several distinct types that you

application can set by querying the end user and that you can cite in later statements by embedding the variable name in the text presented in a consultation.

The main types of variable available in KRL are facts, numbers, categories, and phrases. These variables exemplify the

**ES/P**  
Advisor can handle applications that guide the user step by step through a complete process, giving all the essential information at each stage.



As this *ES/P Advisor* application illustrates, you can even use an expert system to create a blueprint for designing other expert-system applications.



useful methods that sophisticated knowledge-engineering systems offer for differentiating between the various characteristics of a problem. They comprise a versatile and flexible system for passing knowledge back and forth between you and the system as well as for processing the knowledge within the system. This ability to communicate concepts clearly is the key to offering worthwhile advice and results for real-world problems, and for constructing efficient knowledge systems that can run in the smaller memory space of microcomputers.

The KRL's fact parameters tell the *ES/P* consultation shell that the knowledge feature in question can be settled by a yes-

or-no question that establishes whether the fact is true or false. For example, a section of a KRL knowledge base might read

```
expert: 'This system is expert
level' fact
rule: number of rules >= 500.
```

This statement poses the question to the end user and expects a yes-or-no answer. If the user replies yes, then the rule informs the system that there are at least 500 rules in the system in question. Naturally, this rule is not a valid generalization about expert-level systems. The number of rules by itself is not an adequate criterion to evaluate the level at which a knowledge system operates.

The number parameters require the *ES/P Advisor* shell to determine the numerical quantity in question. You must specify the values permitted for numerical parameters in a range declaration. The number types include positive integers and both positive and negative floating-point decimals. KRL also recognizes scientific notation. You can specify that number parameters be calculated, deduced from a rule, or asked of the user.

KRL category parameters are qualitative features that can take any number of specified string values. When you use the option declaration, the consultation shell builds a menu of the listed category options and asks users for their selections. If the following category definition were made:

```
color: 'The color attribute of
your RGB monitor screen'
category
options black, blue, green,
cyan, red, magenta,
yellow, white
askable 'Which color
foreground setting would
you like?'
```

*ES/P Advisor* would ask the user, "Which color foreground setting would you like?"

**KRL,** the knowledge representation language used with *ES/P Advisor*, is one of the more versatile and sophisticated languages currently available for the PC.

and would then present the eight color options previously listed.

The phrase parameter allows you to refer to pieces of text relating to the current problem by name; its value can be set either by asking the user or by proving the conditions of a rule. The phrase parameter can be referenced and automatically inserted in any statement through the use

of an "at" sign (@) prefix before the name of the phrase.

## Logical Operations

One of the main advantages of *ES/P Advisor's* PROLOG heritage is a full set of logical operators that can be used in creating rules in the knowledge base. For example, both the normal inclusive "or"

```

%----- %
% THE MICRO EXPERT SYSTEM ADVISOR %
% Copyright (C) 1984, Ernest E. Telle %
%----- %

title "The Micro Expert System Advisor".

% THE MICRO EXPERT SYSTEM ADVISOR %
%
%
% Hello, I am the Micro Expert System Advisor.'s "S
% I can Provide Advice on Conducting Knowledge Engineering Projects."
%
% I am delighted to make your acquaintance, "... User_name .

user_name = 'getting acquainted' phrase
askable "Can you please tell me your name?".

(expert_system_type=planning)
reference choices .
expert_system_type = 'getting expert system category'
category

 options

 interpretive - " Interpretive Infers situation from sensor data",
 predictive - " Predictive Computes likelihood of future events",
 diagnostic - " Diagnostic Infers malfunction type from symptoms",
 design - " Design Configures system based on requirements",
 planning - " Planning Determines a sequence of actions",
 monitoring - " Monitoring Compares observations to alarm states",
 debugging - " Debugging Prescribes remedies for malfunctions",
 repair - " Repair Executes a plan to apply a remedy",
 instruction - " Instruction Evaluates and corrects student performance",
 control - " Control Interprets and adjusts system operation"

 askable "What type of Expert System are you building?".

reference choices .

%----- %
% Choices Section %
%----- %

section choices :
% RULES %

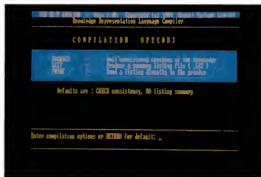
(expert_system_type = diagnostic and not reliable_data)
% Use a probabilistic method, like that in the MYCIN expert system.",
(expert_system_type = interpretive and solution_space = unsatisfy)

```

Figure 1: The Micro Expert System Advisor a sample expert system that will help you select a knowledge representation scheme for expert systems of various types, including interpretive, predictive, diagnostic, and so forth.

and the exclusive "or" are available for specifying both the conditions and consequences of rules. In many production-rule knowledge-engineering systems, even the normal "or" is not available. This is a very important feature, because frequently any one of a number of conditions may be sufficient for a particular outcome. Most rule-based languages only provide for "and" operators between the conditions and consequences of rules; all of the conditions must hold for the consequence to follow. To include a provision where any one of a number of conditions is sufficient, you must include a separate rule for each of the "or" conditions. This feature allows far more efficient knowledge bases to be constructed because near-duplication of rules is avoided.

With the inclusive "or" operator you can, for example, state the rule: "If the person is unconscious, or the person is bleeding profusely, or the person does not answer to his or her name, then call an ambulance immediately." Without an inclusive "or" operator, the same knowledge capsule would have to be represented by three separate rules. The "xor," or exclusive "or," operator offers an additional convenience. With it you can specify that only one of a list of fact parameters



**Figure 2:** After completing a knowledge base, you must use the compiler to translate it into optimized PROLOG.

### The KRL Compiler

Once you have completed a knowledge base, it is not yet ready to be run. You first have to use the compiler to translate it into optimized PROLOG so that it will be accepted by the consultation shell. When the compiler is invoked, it first asks you for the name of the knowledge base file. After you've obliged, it asks you to choose a number of options for using the compiler (see Figure 2).

Each time a new knowledge base is compiled, it is passed through a syntax checker that attempts to find any syntax errors in the knowledge base that will prevent it from running properly. If it finds any errors, it quotes the context and marks the space where the error was detected. Because the syntax of the KRL representation language is very strict, this syntax checking is essential for any serious expert-system development, just as it is for conventional software development. This feature, however, needs further work. During my preparation of the sample knowledge base, the compiler accepted the knowledge base on a few occasions without any error messages and then compiled, but the resulting compiled knowledge base file caused the consultation shell to abort during a session.

### The Consultation Shell

In the final analysis, what really counts are the benefits end users can enjoy in consulting a finished knowledge-based application. Much of this benefit depends upon the environment in which the finished knowledge bases are run. The ES/P consultation shell offers a well-designed multiple-panel display that makes good use of the IBM Color/Graphics Adapter's color attributes. It offers such conveniences as a catalog of current knowledge bases and their filenames (see Figure 3). It is also possible to save a log of any session in a file on disk. As a user, when the consultation shell first comes up, you see following the prompt: "Do you want to restore a previously saved session [Y/N]?" Generally, you would respond N to this question, but sometimes you might want to review an earlier session. When you are running a knowledge base, the session usually proceeds with a series of questions; your responses tell the system how to proceed in searching for an answer to the problem you want to solve. You can request help at any time during a session by typing Help or a question mark in response to any question. You also benefit from ES/P's ability to give you advice in the middle of a session. Figure 4 lists the

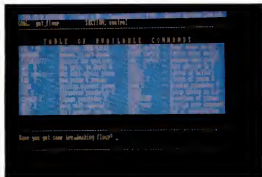


Figure 4: More commands are available to users during an ES/P Advisor consultation than with any other system.

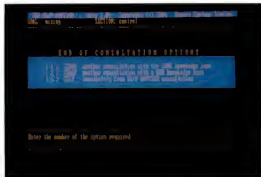


Figure 5: The options provided on the final consultation screen illustrate ES/P Advisor's ease of use.

commands available during a consultation, and Figure 5 is the final consultation screen.

### PROLOG-1 Interface

Another unique feature of *ES/P Advisor* is its open-ended architecture; it has an interface to the Clocksin and Mellish dialect of PROLOG as implemented in PROLOG-1. You can add features to expert systems not supported by *ES/P Advisor* by implementing them in PROLOG-1 and adding the code directly to your knowledge base. You must purchase this PROLOG interface separately. For those who know PROLOG well enough to make use of it, this feature can make *ES/P Advisor* an attractive starting point for developing applications that require hand-crafted features to solve problems efficiently.

PROLOG code can be added in two places in a KRL knowledge base. You can enter it as a pseudoparagraph in which a PROLOG goal is invoked just as advice text would ordinarily be displayed, or you can add a PROLOG function as part of any rule used to deduce the value of a parameter. Although there are no restrictions on the PROLOG code that can be added, there are also no error-trapping features for PROLOG in the KRL compiler. The user guide adequately documents this facility and gives examples, but naturally a working knowledge of PROLOG-1 is required. It might be possible to add some simple things without having a PROLOG inter-

preter, but for any extensive use of the PROLOG interface, you'll need a PROLOG system for adequate debugging.

### Summary

On the whole, *ES/P Advisor* is one of the most flexible and powerful knowledge-engineering tools that I've seen for the PC. The drawback is that you trade the added power for more difficulty in development. I found the KRL language harder to work with than a knowledge-representation tool ideally should be. An important requirement for the preparation of knowledge-based software is that the developer or knowledge engineer should have as fully transparent an environment as possible to work with, so that he or she can focus on the selection, organization, and formulation of the knowledge components. The KRL language is still too much like an ordinary programming language, in that concern about obscure syntax errors takes attention away from the knowledge-engineering process.

Once a debugged knowledge base has been developed, though, the *ES/P* consultation shell is one of the best environments available on the PC for running an expert system. The user has more commands available for taking the initiative than almost any other system, and the interface has no odd quirks or blemishes.

Because only experienced programmers are likely to be able to handle the rigors of the KRL language, I do not recommend *ES/P Advisor* for firms that do not have software expertise. I also do not consider it easy enough to use to be suitable for rapid prototyping. But it is appropriate for firms interested in developing expert systems for the commercial marketplace or for in-house use. Because of its text animation feature, which allows copious textual information to be presented in a step-by-step progression, *ES/P Advisor* is particularly well-suited for preparing dynamic on-line manuals. ■



**ES/P Advisor**  
Expert Systems International  
1150 First Ave.  
King of Prussia, PA 19406  
(215) 337-2300  
List Price: \$895  
Requires: 256K RAM, DOS 2.x, two disk drives.

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**CIRCLE 326 ON READER SERVICE CARD**



Unlike other expert systems, TIMM-PC makes "educated" guesses about solutions to problems—even if you don't give it all the facts.

# Marching to a Different Drummer

**W**hen tackling real-life problems, you often lack some of the information you need to solve them. *TIMM-PC*,

from General Research, is the first micro-based expert system that can handle such problems. *TIMM-PC* offers a unique approach to rule-based systems: It logically thinks about the various ways to solve problems when some crucial information is missing or inadequate.

*TIMM-PC* solves problems by introducing a new method of making knowledge representation more accurate and more able to mirror real-world situations. For example, some statements and situations are black and white, such as "Martha is pregnant." She either is or she isn't. The binary bits in a computer work the same way: They are either ones or zeros; they can't have a value in between. However, not many situations are like this in the real world.

On the other hand, if you say, "Martha

is getting a little plump," then you can appropriately compare her excess weight to someone else's or to describe her degree of plumpness. It's not an all-or-nothing attribute. Similarly, most statements vary by degrees, but this is often not easy to convey in logical expressions or in computer data structures. *TIMM-PC* uses pattern-matching techniques that allow it to differentiate between statements that vary continuously and those that have an all-or-nothing quality.

Most software responds to what you say but not to what you mean. Programs and commands usually follow the all-or-nothing principle because most interpreters and compilers use an all-or-nothing technique for character-string matching. For instance, if the syntax isn't completely correct, the program flashes an error mes-



sage. In contrast, *TIMM-PC* uses a "partial match" procedure that employs a useful application of the "nearest neighbor" search algorithm.

### If-Then Rules and Linking

Like most expert systems that are now on the market, *TIMM-PC* uses a production rule approach. In other words, knowledge is encapsulated into distinct rules comprised of "if" conditions and "then" results. What is different, though, is that *TIMM-PC*'s knowledge base begins with a special declaration section that contains specific information about the attributes that will be used in individual knowledge base files.

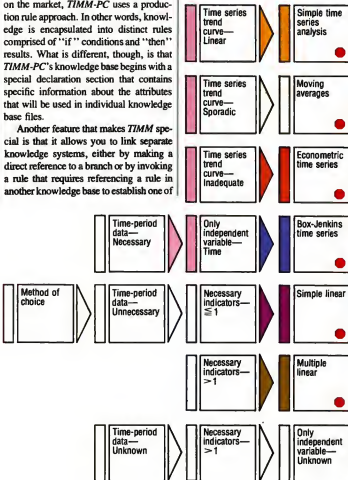
Another feature that makes *TIMM* special is that it allows you to link separate knowledge systems, either by making a direct reference to a branch or by invoking a rule that requires referencing a rule in another knowledge base to establish one of

the rule's conditions.

*TIMM-PC* comprises ten programs that come on five floppy disks, all of which are accessed from a common menu. The program also includes a *SETUP* program for installing the system with its directories

### Since

*TIMM-PC* is the only expert system available that's entirely prompt-driven, the skimpy documentation is not really a serious problem.



and subdirectories on your hard disk. *TIMM-PC* requires an 8087 math coprocessor and, at this time, can't run without a hard disk. A thin 39-page manual and one very brief demo knowledge base, appropriately called CASH, accompanies the software. Since *TIMM-PC* is the only expert system available that's almost

entirely prompt-driven, the skimpy documentation is not really a serious problem. *TIMM-PC* asks you for what it needs at every step of the way during the development of an application.

*TIMM-PC* always chooses a result and estimates its reliability, even when very little information is supplied and the reliability is very small. It can do this because of the way it represents a problem and its "solution space." Each factor of a problem is considered as a coordinate of a "point"; the values supplied by an end user specify the coordinates of this point. *TIMM-PC* always looks for the most similar points already in its knowledge base and, on that basis, can always make some kind of a choice. The program supplies a number that indicates the reliability of its solution.

### Using *TIMM-PC*

Unlike some expert systems, *TIMM-PC* does not contain two distinct environments, one for users and one for developers. All of the programs for development and for consultation are accessible from the same main program menu (see Figure 1). And the development does not stop after a rule base is created. After each session, the data can be updated to reflect the new choices.

One of the major disadvantages of *TIMM-PC*'s organization system is that you are unable to build run-time systems that include only the user environment without all the development tools. And because of *TIMM-PC*'s high price, the system probably won't be used for developing commercial products. Moreover, for many user applications, *TIMM-PC*'s limit of 25 outcome choices may not be at all sufficient—most serious expert systems are expected to handle more choices than that.

Despite this limitation, however, the system does allow you to develop some extremely useful applications. For exam-



*This TIMM-PC application helps users choose among popular business forecasting methods. TIMM's approach allows it to recommend a solution even if the user is missing some necessary pieces of information.*

## TIMM-PC

is best suited for solving problems for which a large number of factors are used to determine a diagnosis, or for a decision limited to 25 or fewer possible alternatives.

ple, *TIMM/Tuner*, an expert system developed with *TIMM-PC* by Dr. Stephen Kiselewich at General Research for the VAX computer, assists in tuning the VAX/VMS operating system. Although *TIMM-PC* offers only four choices for possible outcomes of the diagnosis, you can use over 100 parameters of system operation to determine these four problem types. *TIMM-PC* is best suited for solving problems for which a large number of factors are used to determine a diagnosis, or a decision that is limited to 25 or fewer possible alternatives.

### Building a Knowledge Base

When you want to begin defining a new knowledge base, you run *TIMM-PC*'s BUILD program. You specify all the possible choices that will provide all of the various outcomes for your sessions with the expert system. If, at some later time, you find that you have to add more choices or change or delete the ones you entered, you run the MODIFY program, specify the factors as either numbers or descriptive phrases, and declare whether their values are unordered, linearly ordered, or circularly ordered. This declaration process is one of the key innovations of *TIMM-PC* because it helps create the declaration sec-

tion for the knowledge base. Linearly ordered values represent factors that form an ordered sequence such as the values for prosperity: boom, solvency, or bust. Circularly ordered values apply to factors that go through a sequence and then return to the beginning and start over, such as the weekdays: Monday, Tuesday, and so on.

Given the type of order that applies to a factor, *TIMM-PC* has the capability to do some reasoning on its own to fill in limited information. For example, if some rules in a *TIMM-PC* knowledge base specify that both a multinational business and a local business can be accounting firms, then the system will be able to conclude that an interstate business can also be an accounting firm because the values of the range-of-operations of the business form a linear order and "interstate" is an established value that lies between the two extremes.

When it comes time to "train" your knowledge base, *TIMM-PC* asks you whether it should choose the training cases for you. When you run the training program, you assign various certainty factors to the possible result choices but not to the attributes or factors of each test case. Any number of people, even if they disagree about answers to the same question, can run the training session, and, if needed, their responses will be averaged. *TIMM-PC* uses similarities to reach its conclusions, so no test case becomes an absolute measure. The system uses all of the test cases as guideposts to mark out the boundaries of the problem at hand. You should try to enter the most extreme cases that are likely to occur in real-world problems. The better the cases that are entered, the better *TIMM-PC* will be able to make educated guesses when key information is missing.

### Exercising Knowledge Bases

With the EXERCISE program, you are able to exercise (or, in ordinary layman's



Figure 1: The main menu allows you to access all of the programs for both development and consultation.

When exercising a knowledge base, you can choose between four main modes. Of the four possible combinations, you can choose whether to have *TIMM-PC* choose the test cases for you or choose them yourself, and you decide whether

Because *TIMM-PC* operates differently from the usual production rule system, the "explain," or "justify" facility works differently too. If you want to know why *TIMM-PC* came up with the result it did, you can select the E option from the final

**Figure 2:** These rules and statements make up a knowledge base that helps users choose among the popular business forecasting methods. Extensive prompting by the system helped the author create the knowledge base.

**TIMM**  
differs  
substantially  
from many  
other expert  
systems. It is  
an inference  
engine that  
reasons on  
the basis of  
similarity  
rather than  
exact  
matching.

menu, and the program will list all the rules in the knowledge base that were similar enough to the current problem that they were actually applied in making the choice.

As another option for using a finished knowledge base, you can ask *TIMM-PC* to attempt, via the *GENERALIZE* program, to generate new rules by looking for items in the knowledge base that appear to be grouped. *TIMM-PC* fills in blanks in the "solution space" according to patterns that would suggest plausible guesses about the values. You can choose whether you want *TIMM-PC* to display the generalizations for your approval. If you say yes, each time *TIMM-PC* arrives at a proposed generalization, it displays the new rule to you and asks for your approval or disapproval.

The *INQUIRY* utility is helpful because it allows you to review an expert system's decision structure. You can choose to have this information sent to a disk file to be printed at a later time. A submenu asks you to choose either D for decision structure, K for knowledge base, or N for the number of rules. Looking at the knowledge base, you can see a rule by supplying its number, or you can type ALL to see all the rules. The decision structure contains the names of the various choices, the names and allowable values of the factors, and the "verbose" names and help instructions that go with each of them.

### A TIMM-PC Application

The best way to evaluate an expert system is to examine an application produced using that particular system. Figure 2 is a knowledge base that applies some broad information to assist you in the choice of one of the popular methods of business forecasting. Since *TIMM-PC* is almost entirely prompt-driven, I indicated the actual steps that I used to create my business-forecasting knowledge base in addi-

tion to the listing of the rule base.

*TIMM* differs substantially from many of the other expert systems I have seen for the PC. It is an inference engine that reasons on the basis of similarity rather than exact matching, which permits it to cope with situations where key pieces of information may be lacking. On the other hand, it has three principal limitations: (1) its upper limit of 25 choices restricts the type of problems for which it is suitable; (2) the absence of arithmetic and other math operators means that the result of a consultation cannot contain numerical values that have been calculated on the basis of values obtained interactively from a user; and (3) the user and development environments are not separate, so delivery systems cannot be provided to users at a cost lower than the full purchase price of the *TIMM-PC* program.

The promotional literature for *TIMM-PC* suggests that it can be used by a company to develop expert systems in the areas of "manufacturing, customer service, quality control, engineering, marketing, finance, personnel, research, and development." Exactly what types of problems might be handled in any of these areas and the level of complexity that they can have is determined by the basic limitations I have already mentioned. On the whole, if a problem area falls within the range of those that *TIMM-PC* is competent to handle, it provides some very unique tools for its solution. ■



### *TIMM-PC*

General Research  
7655 Old Spring House Rd.  
McLean, VA 22102  
(703) 893-5900

List Price: \$9,500

Requires: 640K RAM, hard disk, DOS 2.x, 8087 math coprocessor chip.

CIRCLE 715 ON READER SERVICE CARD

Powerful M.1's use of PROLOG-1 and clear presentation of program activity make it appealing to serious expert-systems developers.

# M.1 Makes A Direct Hit

To build a useful expert-system application, you need a certain kind of problem and the right expert. But these ingredients won't be enough unless you also have the right software. Your end product must not only give users timely and relevant advice but also allow them to see and comprehend the rules the program uses in making decisions.

This combination of qualities was hard to come by in early expert systems, which were often developed in special artificial intelligence languages not exactly noted for readability. *M.1*, a development tool from Teknowledge, allows IBM PC users to create expert systems using "knowledge-based" rules written in an English-like language.

Founded to market expert-systems technology, the Palo Alto-based Teknowledge is a Stanford University spin-off that boasts such artificial intelligence notables as Edward Feigenbaum, Avron Barr, and Bruce Buchanan. Until now, the com-

pany has chiefly sold high-priced, customized expert systems to large corporations based both in the United States and Europe; its introduction of the *M.1* system highlights a growing demand for smaller, less-expensive development tools.

Although less expensive, at \$10,000 *M.1* is still hardly within the means of most PC users. Corporations undoubtedly will continue to be Teknowledge's major customers. From Teknowledge's point of view, however, this price is a big step down from the \$50,000 to \$100,000 usually charged for full-blown expert systems that work on Digital Equipment VAX computers or more specialized systems such as the Xerox Star.

According to the company, *M.1* is best suited to "structured selection" applica-



## Priced

at \$10,000, M.1 is hardly within the means of most PC users. Corporations undoubtedly will continue to be Teknowledge's biggest clients.

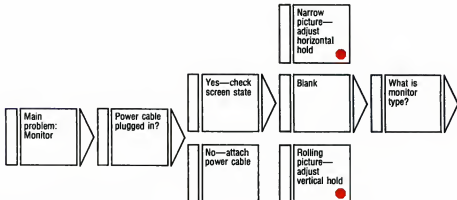
tions. Teknowledge defines such problems as those which a human expert can usually solve in less than 30 minutes, which do not involve extensive calculations, can be solved through a telephone discussion with an expert, and have only a few dozen conclusions to choose from. (Calculations are limited because although M.1 can handle numbers between 0 and 16,383, it cannot cope with negative integers.)

At one level, M.1 can be used to create what are essentially "intelligent manuals" that clients can consult in a question-and-answer fashion. Teknowledge says that it is already working with customers on intelligent-manual applications in fields such as insurance, banking, automobile diagnosis and repair, and even process monitoring (although not process control). On another level—although only to a limited extent—M.1 can be used for applica-

tions that require such features as intelligent data logging.

The demonstration expert systems supplied with M.1 include a Wine Advisor (which recommends what type of wine to serve with meals), a Bank Services Advisor (which matches your banking requirements with bank services), a Photography Advisor (which uses information about environmental conditions to recommend the shutter speed and film type to use), and a version of the famous Sacon system (which aids structural analysis engineers in using a very complex FORTRAN program).

PC users who want to dabble with the M.1 environment but have limited resources or are uninterested in developing commercial applications can do so with Teknowledge's M.1a system, a \$2,000 "lobotomized" subset of M.1; you can explore M.1's major features, but the

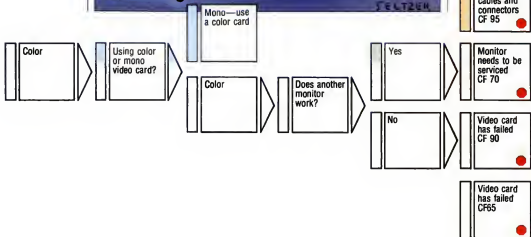


*With M.1 you can develop identification applications or complex diagnostic routines, such as this one which helps you identify monitor ailments.*





Mono—use  
a color card



## M.1

is best suited to "structured selection" applications in which a human expert could solve the problem in less than 30 minutes.

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monitor  
cables and  
connectors  
CF 95

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has failed  
CF65

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| dBase III                               | 355.        |
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| PC/Tax Cut                              | 129.        |
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| Personnel (Level 3)                     | 559.        |
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| THE WORD (KJV Bible - 7 disks)          | 145.        |
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| Sidekick (non-protected)                | 49.         |
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| WordVision                              | 39.         |
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| Sideways                                | 45.         |
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| ThinkTank                               | 109.        |
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| 1-2-3                                   | call        |
| Symphony                                | call        |
| <b>Micro Education (MECA)</b>           |             |
| Managing Your Money                     | see special |
| Running Program (Jim Fixx)              | 49.         |

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through April 30, 1985

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| Microsoft Serial Mouse with software | 135. |
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|---------------------------|------|
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|---------------------------|------|

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|------------|-----|
| PFS Access | 59. |
| PFS File   | 85. |
| PFS Graph  | 85. |

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| PFS Plan                   | \$85. |
| PFS Proof                  | 59.   |
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| Supercalc 3                | 199.  |
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| Micro Cookbook             | 29.   |
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|                   | each 32         |
| How to Use:       |                 |
| Compaq            | PC-DOS (2.1)    |
| Basic             | Home Accountant |
| IBM-PC            | VW Deluxe       |
| MS-DOS (2.0)      | TKISolver       |
|                   | each 32         |

### TRAINING POWER PROGRAMS

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| MS Word     | Easywriter II | Multimate     |
| Multiplan   | Supercalc 3   | Framework     |
| Symphony    | Wordstar      |               |
|             |               | ..... each 49 |

### Comprehensive Software

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| Intro to Communications                  | 39. |
| Intro to the Operating System (PC Tutor) | 39. |

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| Professor DOS                   | 47. |
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| Typing Instructor               | 39. |

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| Master Type                                                              | 35.  |

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| Word Attack (grades 4-12)                                                                            | 35. |
| Spell II (grades 5-adult)                                                                            | 35. |
| Additional Data Disks for other ages are available for Speed Reader II and Word Attack at \$15. each |     |

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| OwlCat SAT (60 hour)             | 169  |
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| Story Machine (ages 5 to 9)                                             | 23 |
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| Hey Diddle Diddle (ages 3 to 10)                                        | 20 |
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| FriendlyWare/PC Arcade | 35 |
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### Hayden Software

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|------------|----|
| Sargon III | 35 |
|------------|----|

### Infocom

|                                    |  |
|------------------------------------|--|
| Difficulty levels shown in italics |  |
|------------------------------------|--|

|                     |    |
|---------------------|----|
| Seastalker (junior) | 25 |
|---------------------|----|

|                      |    |
|----------------------|----|
| Enchanter (standard) | 25 |
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|                        |    |
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| the Witness (standard) | 25 |
|------------------------|----|

|                       |    |
|-----------------------|----|
| Planetfall (standard) | 25 |
|-----------------------|----|

|                     |    |
|---------------------|----|
| Cuthroat (standard) | 25 |
|---------------------|----|

|                               |    |
|-------------------------------|----|
| Hitchhiker's Guide (standard) | 25 |
|-------------------------------|----|

|                   |    |
|-------------------|----|
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|-------------------|----|

|                    |    |
|--------------------|----|
| Zork II (advanced) | 29 |
|--------------------|----|

|                     |    |
|---------------------|----|
| Zork III (advanced) | 29 |
|---------------------|----|

|                    |    |
|--------------------|----|
| Infidel (advanced) | 29 |
|--------------------|----|

|                     |    |
|---------------------|----|
| Sorcerer (advanced) | 29 |
|---------------------|----|

|                    |    |
|--------------------|----|
| Suspect (advanced) | 29 |
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|                   |    |
|-------------------|----|
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|-------------------|----|

|                    |    |
|--------------------|----|
| Starcross (expert) | 33 |
|--------------------|----|

|                    |    |
|--------------------|----|
| Suspended (expert) | 33 |
|--------------------|----|

|                                                                               |   |
|-------------------------------------------------------------------------------|---|
| Invisiclus (hint booklets are available for all Infocom games. Specify game.) | 7 |
|-------------------------------------------------------------------------------|---|

### Microsoft

|                  |    |
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### Origin Systems

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## HARDWARE

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| MegaPak 256k                                                                                                                                    | 339 |
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| Parallel Game or second Serial Port for any AST board (specify board)                                                                           | 35  |
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### Cuesta Systems

|                                |      |
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#### STANDS

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| Ruby (switched 6 outlets; EMI/RFI filter; 6 ft cord) | 63 |

For the IBM-PC Exclusively.

# PC CONNECTION®

## M.I.'s

ability to run on a basic 128K PC is quite impressive.

Most early expert systems required a megabyte or two of main memory just to feel at home.

facilities to develop an operational expert system have been disabled. Teknowledge also markets *T.I.*, a \$595 videotape/manual package intended to serve as an introduction to the field of expert systems.

*M.I.* is written in PROLOG-1, a compact version of PROLOG, and can therefore be used quite satisfactorily on a two-drive, 128K IBM PC. (With a color monitor, *M.I.* will use different colors to distinguish system output from your responses.) *M.I.*'s ability to run on such a basic PC is quite impressive, since the early expert systems typically required a megabyte or two of main memory just to feel at home. IBM PC users who want to install *M.I.* on a hard disk should be aware that the system disk is copy protected, so it must be kept in the default floppy drive like Lotus's 1-2-3.

## System Architecture

The conventional way to describe the architecture of an expert system is to divide it into two major components: the *knowledge base* and the *inference engine*. The knowledge base comprises a collection of statements, or rules, about some particular topic. The rule format is "IF expression THEN conclusion." An acceptable rule in an *M.I.* knowledge base

might state, "IF building = Empire State THEN building = tall."

The inference engine checks your input against rules in the knowledge base to find if there are any matches, such as Empire State with tall.

In many systems, the distinction between the knowledge base rules and the inference engine is not always crystal clear. You might not be able to point to a section of code and say "There it is, the inference engine." *M.I.*, however, gives you no opportunity to confuse the two components. The PROLOG-1-based inference engine is a distinct mechanism with which you communicate via the command line prompt *M.I.*> (see Figure 1). This interface is modeled along the lines of the MS-DOS operating system's. You never really "see" DOS; you just enter commands at the A> prompt. *M.I.* operates in the same manner.

In *M.I.*, the knowledge base is also a distinct component, created by using a standard text editor such as *WordStar*. This separation of the inference mechanism and the knowledge base is a nice idea. You can create as complex a knowledge base as you want within a familiar text-editing environment and then access that text file from within *M.I.* This arrangement might be limiting to really sophisticated users, but they probably would switch to a VAX or Star system for heavy-duty work.

## Command Structure

*M.I.* has an easy-to-learn command structure. To load a knowledge base, enter "load file." To start a consultation, enter "go." The one aspect that will probably trip you up for the first hour or so is that you must end all commands with a period. If you don't, *M.I.* ignores whatever command you entered and even rejects a second, correct attempt (it's a real case of third time lucky, so pick up the habit of using a period early).



Figure 1: *M.I.*'s minimal user interface allows direct communication with the inference mechanism.

### Setting Up an M.1 System

Before you can begin to develop an expert system with *M.1*, you must become familiar with the *M.1* knowledge base syntax and statement options. Like other high-level languages, the *M.1* syntax offers facilities for printing text and for using variables, math functions, and special features such as list processing. This latter feature might be used to sum a list of values recorded at various points during a consultation.

The *M.1* system operates in compiler fashion in that it checks the syntax of a knowledge base each time it is loaded, reporting errors and placing a marker as near as possible to the offending text. Since you must flip to and fro between the *M.1* environment and your word processor to make sizeable corrections, this method can be a little cumbersome if you are dealing with a large knowledge base. (*M.1* allows up to 200 rules to be used at one time—enough to create a fairly complex application—although more can be used via an overlay feature.) Small changes can be made from within *M.1* by means of the add/delete rule facilities, and rules can also be listed by number via the list command.

### The UFO Adviser

The demonstration UFO Adviser system in Figure 2 shows how you might go



#### M.1

Teknowledge, Inc.  
525 University Ave., #200  
Palo Alto, CA 94301  
(415) 327-6600

List Price: \$10,000; includes one developer's copy and five runtime copies, maintenance for first year, phone support.

Requires: 128K RAM, two disk drives.

CIRCLE 726 ON READER SERVICE CARD

about setting up a simple *M.1* expert system containing three rules. (It should be pointed out that both UFO Adviser and PC Fault Adviser are not "real" expert systems but are just two trivial examples of *M.1*'s facilities.)

At the beginning of the UFO knowledge base, I placed the statement

```
goal=uf0-id.
```

This statement tells *M.1* that the consultation will be over when an acceptable value

```
goal=uf0-id.

/* ----- IT'S A BIRD ----- */
rules: if bird = yes
 then uf0-id = bird.

/* ----- NO, IT'S A PLANE ----- */
rules: if plane = yes
 then uf0-id = plane.

/* ----- MAYBE IT'S SUPERMAN ----- */
rules: if not (bird) = bird
 and not (plane) = plane
 and (leap=tail-buildings = yes
 or can-stop-locomotives = yes
 or has-aversion-to-kryptonite = yes
 then uf0-id = superman of 99.

/* ----- BIRD ----- */
question(bird) =
 "Is it a bird?".
legalval(bird) =
 (yes,no).

/* ----- PLANE ----- */
question(plane) =
 "Is it a plane?".
legalval(plane) =
 (yes,no).

/* ----- LEAP=TAIL-BUILDINGS ----- */
question(leap=tail-buildings) =
 "Can it leap tall buildings in a single bound?".
legalval(leap=tail-buildings) =
 (yes,no).

/* ----- CAN-STOP-LOCOMOTIVES ----- */
question(can-stop-locomotives) =
 "Can it stop locomotives?".
legalval(can-stop-locomotives) =
 (yes,no).

/* ----- HAS-AVERSION-TO-KRYPTONITE ----- */
question(has-aversion-to-kryptonite) =
 "Does it have an aversion to Kryptonite?".
legalval(has-aversion-to-kryptonite) =
 (yes,no).
```

Figure 2: The UFO Adviser program demonstrates a simple *M.1* expert system with only three rules.

**The cf**  
or certainty  
factor value,  
which must be  
an integer  
between 0 and  
100, is a key  
concept in  
building expert  
systems with  
M.1.

for ufo-id is found (remember that all M.1 commands end in a period).

Rules 1 and 2 are similar in that they both offer a value for ufo-id. If we loaded this text file into M.1, the inference mechanism would begin by seeking a value for ufo-id and immediately come across Rule 1, which states:

```
if bird = yes then ufo-id =
bird.
```

Since this expression cannot be evaluated until a value for bird is found, M.1 searches through the knowledge base to see if there is any other entry that can help.

The only entry that fits the bill is the "question (bird)" statement, in Figure 2. Coming across this, M.1 attempts to find a value for bird by asking you the question shown in Figure 2 within single quotes. The screen would then look like this:

```
M.1>go.
Is it a bird? >>
```

If you type  
yes.

in response, M.1 then concludes that  
ufo-id = bird (100%) because  
you said so.

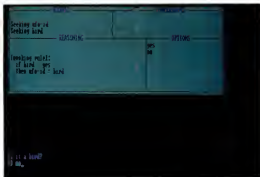
If you respond no, M.1 cannot find a value for bird and consequently moves on to Rule 2, trying to evaluate that entry in the exact same manner. If, on the other hand, you answer that the UFO is neither a bird nor a plane, then M.1 must try and solve Figure 2's Rule 3, which requires that a more complex set of facts be evaluated before it can find ufo-id.

### Certainty Factors

For each question entry there is an accompanying "legalvals" entry that specifies the acceptable responses or values. This legal response checking is quite similar to the legal value checks that can be performed on field entries in database systems. Text, integers, and real numbers are all accounted for.

Rule 3 is fairly self-explanatory, except for the "cf 99" entry that appears at the end. The letters cf stand for certainty factor, and 99 indicates that if all the necessary preceding values in Rule 3 are found to be true, then the UFO is superman with a certainty factor of 99 percent. The cf value, which must be an integer between 0 and 100, is a key concept in building expert systems with M.1.

In the UFO Adviser, the cf factor for



**Figure 3:** Figure 3a (left) shows an early screen of the UFO Adviser program in Figure 2. The four windows at the top indicate the program's activity; the bottom half records the program's questions and the user's answers. Figure 3b (right) shows the final screen. Since the UFO is neither a bird nor a plane, M.1 must test a more complex set of facts before the ufo-id is found.

ufo-id doesn't really matter at all, since it will not be combined with any other cf factors. In real-world systems, many entries will be given varying certainty factors. For example, the Wine Adviser demonstration expert system supplied on the *M.I.* system disk includes these rules:

```
if main-component = poultry
 and has-turkey = yes
then best-color = red cf 80
 and best-color = white cf
 50.
```

```
if main-component = poultry
 and has-turkey = no
then best-color = white cf 90
 and best-color = white cf of
 30.
```

In such a context, *M.I.* will decide among a number of options in response to your input. It moves through the knowledge base paying attention only to the most relevant rules.

Certainty factors are not used only in hard-coded form in knowledge bases, however. You may answer a question with certainty factors to indicate varying degrees of truth or falsity. If you attach no cf factor to a response, *M.I.* interprets the input as having a certainty factor of 100 or 0 percent, depending on the context.

*M.I.* ignores propositions that end up with a certainty factor of less than 20 percent; the typical cf range is 40 (suggesting that enough evidence exists for a proposition to be pursued) to 80 (suggesting definitely sufficient evidence for a proposition to be pursued). At times when you can't attach any certainty to a response, you are allowed to enter the word unknown. This entry has the same effect as if you had entered a response with a cf value no greater than 20.

### The Cache

When running through an *M.I.* consultation, all you see is a list of questions and

your answers. All the activity takes place in a special section of memory called the cache, which is basically a central holding area that, during a consultation, contains *M.I.*'s intermediate and final conclusions. Each time a rule succeeds—and, in addition, whenever you input a response—a cache entry records the event for later use.

You can then list and change these entries as part of the knowledge-base debugging process, or you can save them to a disk file for later analysis. The "trace" command lets you interactively follow what is happening during a consultation, but probably the most helpful of the debugging tools that *M.I.* offers is the instrument panel.

### Instrument Panel

If you type the command  
panels on.

before starting a consultation, the top half of the PC screen will be divided into four windows labeled Events, Reasoning, Options, and Conclusions (see Figure 3). Below this windowlike arrangement appears the usual question-and-answer text.

The Events window, naturally enough, indicates which events are taking place. In the UFO Adviser example, the first event displayed would be

Seeking ufo-id.

The Conclusions window notes which conclusions *M.I.* has reached in response to your input. If, for instance, you responded "no" to the question "Is it a plane?" the Conclusions window would show that plane = no.

The Reasoning window records how the *M.I.* inference engine invokes various rules in the knowledge base. Messages appear after each rule indicating whether it has succeeded or failed. If you answer "yes" to the question "Is it a bird?" then

### M.1

will decide among options in response to your input. It moves through the knowledge base paying attention only to the most relevant rules.

```

goal-solvit.

/*
THE INITIALDATA ENTRY BELOW TELLS MI THAT HE WANTS IT TO FIND
VALUES FOR THE EXPRESSIONS CONTAINED WITHIN THE SQUARE BRACKETS
BEFORE IT ATTEMPTS TO FIND A VALUE FOR "SOLVIT".
*/

initialdata = [message-printed,main-problem,main-cable-attached].

/* ----- INITIAL MESSAGE ----- */

if display{
 n1,mi,
 **** DEMONSTRATION PC FAULT ADVISOR ****
 Answer the questions as accurately as you can. Make sure that
 you end each response with a period. ' ,n1,mi,
 * Type "OPTIONS," to see the range of responses available to
 you.
 * Type "WHY," to find out why a question is being asked.
 * Type "UNKNOWN," when you cannot answer a question.
 * Type "QUIT," to end the consultation. ' ,n1,mi,mi,mi]
 then message-printed.
}

/* ----- MAIN-PROBLEM ----- */

question(main-problem) =
 'What part seems to be giving trouble?'.
legalvals(main-problem) =
 [monitor,system-unit,disk-drive].

/* ----- MAIN-CABLE-ATTACHED ----- */

question(main-cable-attached) =
 'Is the main cable plugged in?'.
legalvals(main-cable-attached) =
 [yes,no].

/* ----- SCREEN-STATE ----- */

question(screen-state) =
 'What appears to be the problem with the monitor?'.
legalvals(screen-state) =
 [blank,rolling-picture,narrow-picture].

/* ----- MONITOR-TYPE ----- */

/* THIS, AND THE FOLLOWING QUESTION ENSURE THAT THE MONITOR AND
VIDEO-CARD ARE COMPATIBLE.
*/

question(monitor-type) =
 'What type of video monitor are you using? color or monochrome?'.
legalvals(monitor-type) =
 [color,monochrome].

/* ----- VIDEO-CARD ----- */

question(video-card) =
 'Are you using a color or monochrome video interface card?'.
legalvals(video-card) =
 [color,monochrome].

/* ----- OTHER-MONITOR-WORKS ----- */

question(other-monitor-works) =
 'Does another monitor work when attached to your system unit?'.
legalvals(other-monitor-works) =
 [yes,no].

/* ----- SOLVIT ----- */

/*
NOTICE THAT "SOLVIT" IS DEFINED AS BEING A MULTIVALUED
EXPRESSION. THIS SIMPLY MEANS THAT MI WILL NOT STOP LOOKING
FOR A VALUE FOR SOLVIT EVEN WHEN ONE DEFINITE VALUE HAS BEEN
RECORDED. THIS ALLOWS THE EXPERT SYSTEM SUBROUTINE TO PROVIDE
MORE THAN ONE SOLUTION TO A PROBLEM, DEPENDING ON THE VARIOUS
CERTAINTY FACTORS INVOLVED.
*/

multivalued(solvit).

rule1: if main-cable-attached = no
then solvit = 'Connect the power cord.'.

rule2: if main-cable-attached = yes
and screen-state = blank
and monitor-type = color
and video-card = monochrome
then solvit = 'Use a color video card, dummy!'.

rule3: if main-cable-attached = yes
and screen-state = blank
and monitor-type = blank
and video-card = blank
and other-monitor-works = yes
then solvit =
 'Check monitor cables and connectors' of 95.

rule4: if main-cable-attached = yes
and screen-state = blank
and monitor-type = blank
and video-card = blank
and other-monitor-works = yes
then solvit =
 'Monitor needs to be serviced' of 76.

rule5: if main-cable-attached = yes
and screen-state = blank
and monitor-type = blank
and video-card = blank
and other-monitor-works = no
then solvit =
 'The video card has failed' of 63.

rule6: if main-cable-attached = yes
and screen-state = blank
and monitor-type = blank
and video-card = blank
and other-monitor-works = no
then solvit =
 'Video card is not installed in expansion
slot correctly' of 96.

rule7: if main-cable-attached = yes
and screen-state = rolling-picture

and other-monitor-works = yes
then solvit =
 'Adjust the vertical hold'.

rule8: if main-cable-attached = yes
and screen-state = narrow-picture
and other-monitor-works = yes
then solvit =
 'Adjust the horizontal hold'.

```

Figure 4: PC Fault Adviser, another demonstration program, analyzes failures in your PC and advises on their repair.



the Reasoning window will show that Rule 1 succeeded. The Options window merely indicates what your legal responses are to the current question (as dictated by the "legalvals" entry in the knowledge base).

The instrument panel is useful, although at first I thought it a limited feature. When a lot of text occupies each window, however, windows can be confusing, and text is sometimes scattered a bit haphazardly when knowledge base entries are wider than the window they occupy (this problem is most noticeable with the Reasoning window).

### Documentation

The documentation that comes with the *M.I.* system is quite good, but it is designed to be used in conjunction with Teknowledge's one-week training course (cost \$2,500). You can develop simple expert systems by following the basic instructions, but really serious expert-systems work demands much more comprehensive training.

Using *M.I.*, I was able to develop the PC Fault Adviser (see Figure 4) in a couple of hours, but it is only a partial system that I have not optimized in any way. For

example, a number of similar rules in the knowledge base could be collapsed into more-generalized statements by the use of variables. The version shown here is designed to be easy to follow. Figure 5 shows part of an inquiry session with the PC Fault Adviser.

### Good and Getting Better

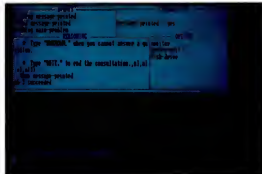
*M.I.* is not the fastest thing on disk by any means, but it is easy to use. The few rough edges in its design probably stem from its original purpose as an expert-system prototyping environment. Client feedback indicating a demand for more flexibility from the product has spurred its designers to revise *M.I.*

According to Teknowledge, a new version of *M.I.* currently in the works will allow assembly language programmers to develop a much-needed software "bridge" between *M.I.* and many popular databases. Further refinements that will make *M.I.* more successful commercially are also under way.

Certainly Teknowledge offers a wide range of expert-system development facilities to the personal computer user with *M.I.*, but at a price. Only serious companies need apply. ■

### M.I.'s

design has a few rough edges, but they probably stem from its original purpose as an expert-system prototyping environment.



**Figure 5:** Left, the beginning of an inquiry session with the PC Fault Adviser shown in Figure 4. Here the windows in the control panel contain mainly introductory information. In a later screen, right, the windows contain status information on the data that *M.I.* has already evaluated, the conclusions it has arrived at, and a rule that it has applied.

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CIRCLE 168 ON READER SERVICE CARD

While not a true expert system, Lightyear forces you to think clearly about your options when faced with a big decision.

# Lightyear's Ahead Of Paper

**T**he toughest part of an executive's job is making decisions. You can hire researchers and consult experts, but no one can make the final decision for you. It's a lonely, uncertain process, and anything that makes it easier is welcome.

*Lightyear* styles itself as "decision-modeling software," and it's designed to help you make those hard choices. It is by no means an expert system and doesn't claim to be one. But like an expert system, it does force you to think clearly about alternatives and to establish your own rules for decision making.

*Lightyear's* approach to making decisions is one everyone has used: list the pros and cons for each alternative and see which side comes out on top. However, the program goes beyond the usual scope of this method by keeping track of far more facts and choices than would be convenient by hand. Like an electronic spreadsheet, all it does is simple arith-

metic; but it does it so quickly and conveniently that it can help you tackle complex problems more easily.

The key to the program is its slick user interface. Entirely menu driven, *Lightyear* is fast and easy to learn. If you take a good look at its excellent manual, you'll hardly ever need its on-line help screens.

The best way to understand *Lightyear* is to watch it work. Lightyear, Inc., designed the program to help you choose from a list of similar alternatives: which product to develop, which computer system to install, which company to acquire. Although it has to stretch a bit, you can even apply *Lightyear* to difficult problems from the world of international intrigue.

Imagine that you work for Minipax, the Ministry of Peace of the Republic of Oce-



**You've**  
gotten the  
word straight  
from Big  
Brother:  
Rutherford  
has got to go.  
But how?  
Lightyear can  
help you  
decide.

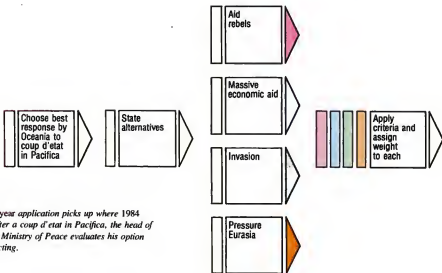
ania. You are in charge of Oceanian policy toward Pacifica, a small, neighboring state that has been run for generations by dependable, pro-Oceanian puppets. However, last month, Pacifica's underground Anti-Oceanian movement overthrew the government in a violent coup d'etat. A few troops loyal to the pro-Oceanian government have taken to the hills and are calling for Minipax aid to topple the new regime. Pacifica's new, self-appointed President-for-Life, George Rutherford, is a rabid anti-Oceanian and has called on Oceania's worst ideological enemy—Eurasia—to send an anti-insurgency brigade to put down the loyalists.

You have gotten the word straight from Big Brother: Rutherford has got to go. But how? *Lightyear* can help you decide.

The first step in building a *Lightyear* decision-making model is to list the alternatives you want the program to help you

evaluate. Figure 1 shows the six different ways you've come up with to get Pacifica back into the fold: (1) Aid the rebels; (2) impose an economic blockade and hope the regime crumbles from within; (3) woo Rutherford away from Eurasia with massive economic assistance; (4) invade Pacifica; (5) assassinate the new President-for-Life; or (6) put pressure on the Eurasians to try to replace Rutherford with a more moderate leader.

In order to choose the best of these options, you have to evaluate each according to a set of criteria, for example, the eight in Figure 2—Oceanic Reaction, World Reaction, Cost, and Loss of Life—the first four are self-explanatory. The fifth, Effectiveness, is a measure of how likely each alternative is to achieve your goal of bringing down the new Pacifican regime. Time Frame is an estimate of how long each alternative will take, and Retal-



*This Lightyear application picks up where 1984 left off: After a coup d'etat in Pacifica, the head of Oceania's Ministry of Peace evaluates his option before reacting.*



iation is a measure of the likelihood of a nasty Eurasian response. Finally, since Big Brother is deeply superstitious, you do a horoscope on each alternative.

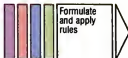
### A Weighty Question

The criteria aren't equally important; each gets weighted from 0 to 100. Effectiveness and the possibility of Loss of Life carry the heaviest weight; Horoscope and domestic reaction within Oceania are the least important.

*Lightyear* uses these criteria in a simple, additive way to keep score on the alternatives. If, for example, an alternative will produce the very best world reaction, it scores 100 percent on the first criteria and gets 75 points. If an alternative is likely to provoke the worst possible world reaction, it will score 0 percent on that criterion and get no points. In-between reactions get intermediate percentages of

### Each

criterion gets weighted from 0 to 100. Then *Lightyear* uses these criteria in a simple additive way to keep score on the alternatives.



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**To**  
jazz up the  
model you can  
throw in a few  
optional rules.  
Lightyear lets  
you write both  
simple and  
if-then rules.

the maximum score of 75 points.

Every alternative is judged according to every criterion, and the alternatives are then ranked according to *total* points. Thus, if an alternative scored 100 percent on every criterion, it would get a total score of 455: the sum of all the weights for all criteria. *Lightyear* lets you devise rules to refine things a little bit, but the guts of the program is simple addition.

But now you have to figure out how to assign the different proportions of each criterion's weight to each alternative. *Lightyear* gives you three ways to do it: numeric, graphic, and verbal. The letters N, G, and V in the Mode column of Figure 2 show which method you've chosen for each criterion. They all do exactly the same thing, so the one you choose is a matter of taste.

The simplest way to use the numeric mode is to use the default scale of 0 to 100. This way, you could indicate 100 different levels of World Reaction, say, with the most favorable reaction as 100 and the least favorable as 0. For criteria that are already numerical, such as cost or number of lives likely to be lost, you can change the default scale. If you figure that the most expensive alternative, an invasion, will cost two billion credits, you can set

that at one end of the scale and set zero credits at the other. In this case, the less money you spend, the happier Minipax will be, so you should invert the value scale and make 0 the 100 percent score and 2 billion the 0 percent score. Cheap diplomacy beats expensive diplomacy every time.

The graphic mode offers a visual way to indicate the range from 0 to 100, allowing you to move Xs back and forth along marker lines. Figure 3 shows the Effectiveness criterion applied to each of the alternatives. You use the right and left arrow keys to move the X; the further to the right, the greater the probability of success. An invasion is sure to bring down Rutherford, but pressuring the Eurasians is chancy. When it's time to tot up the

**10 FACT FILE**

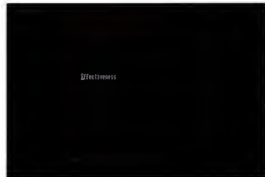
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 Lightyear, Inc.  
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 Santa Clara, CA 95051  
 (408) 985-8811  
**List Price:** \$495  
**Requires:** 192K RAM, one disk drive,  
 DOS 2.x.

---

CIRCLE 756 ON READER SERVICE CARD



**Figure 1:** To use Lightyear to help you make a decision, you first have to make a list of your alternatives.



**Figure 2:** The next step is to choose the criteria and their significance to the decision at hand.



scores, an X all the way to the right gives that alternative 100 percent of the criterion's weight (in this case, 100 points), and one all the way to left gets it nothing.

Figure 4 shows how to use the verbal mode to break up 0 to 100 default range into five gradations, represented by the adjectives in the Reaction box. "Enthusiastic" has a value of 100, "Livid" has a value of 0, and the rest take in-between values. Domestic reaction to an invasion is likely to be livid (even if ineffective), so the Invasion alternative gets 0 percent of that criterion's 25 points. *Lightyear* makes it easy to assign values to different words, and if you think they'll be useful in some future model, you can put them into *Lightyear*'s permanent vocabulary. The Horoscope criterion, for example, assigns different values to words such as *auspicious*, *disquieting*, and *disastrous*.

Once you've rated every alternative according to every criterion, you can run an evaluation. However, just to jazz up the model, why not throw in a few optional rules? Rule definition is menu driven and very easy.

### Learn the Rules

*Lightyear* lets you write both simple and if-then rules to refine your evaluation.

If-then rules have two parts. The first part of the LIFE-SUCCESS rule gives an automatic bonus of 50 points to any alternative that would kill five people or less (WEIGHT = 50). The second part then tests all alternatives that would kill more than five people and gives them the 50 bonus points only if they have a greater than 85 percent probability of success. In effect, this rule penalizes alternatives that involve a probable loss of more than five lives but do not have a good chance of success.

The TIME FRAME-COST rule imposes the same kind of penalty on alternatives that take more than 20 months and cost more than 100 million credits. If you're going to spend big bucks, you want quick results. WORLD REACTION simply tests for and rewards alternatives that produce a world reaction better than Unfavorable.

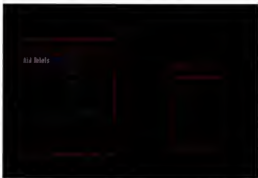
Now that you've built your model, let 'er rip. Figure 5 shows the results. Massive economic aid to the new regime gets the top ranking, with a score of 444 out of a possible 570. (Adding the rules to the model increased the total possible score from the earlier figure of 455.) The invasion option comes in dead last.

*Lightyear* lets you review the evalua-

**The**  
program  
cannot help  
you with  
go/no-go  
decisions; the  
alternatives  
are too  
dissimilar, and  
*Lightyear* can't  
compare  
apples and  
oranges.



**Figure 3:** This screen shows the graphic mode of ranking choices according to a selected criterion.



**Figure 4:** This *Lightyear* screen demonstrates the verbal mode of ranking alternatives.

## LIGHTYEAR

tion by showing you how each alternative stacked up according to each criterion. It lets you do this singly for each alternative, or for two at a time. Figure 6 shows how the top two alternatives compared according to the five criteria with the heaviest weights. (You could look at all the criteria, but only five fit on the screen at a time.) In this chart, the length of each bar indicates the criterion's weight, and the dark part of the bar compares the scores of the two alternatives. Thus, economic aid gets the full 65 points for world reaction, whereas pressuring Eurasia gets only 32 points.

Since different alternatives look better or worse according to which criteria they're judged by, the choice of criteria and weights makes all the difference in *Lightyear's* evaluation. You could make a more ruthless version of the foreign policy model that weights loss of life less heavily and probability of success more. In that case, it might recommend assassination.

### Better for Business

*Lightyear* will probably never be used by a government to decide whether to launch an invasion. It was designed for business decision making and works best at ranking similar alternatives. If your company is thinking of moving its head-

quarters, *Lightyear* can help you evaluate different locations. It can help you choose the right applicant for a job, or the most promising marketing strategy. In cases such as these, each criterion is likely to be equally applicable to each alternative.

*Lightyear* can not help you with go/no-go decisions such as, "Should you set up an exporting subsidiary or not?" The alternatives are too dissimilar, and *Lightyear* can't compare apples and oranges. But once you've decided to export, *Lightyear* could help you decide which foreign markets would hold the most promise.

The foreign policy model described here pushes *Lightyear* to its outer limits. All the criteria can be applied to each alternative, but the alternatives themselves are too varied to fit neatly into *Lightyear's* strictly mathematical ranking system.

For more straightforward choices, when it's possible to assign realistic weights to each criterion and realistic criterion values to each alternative, *Lightyear* can be a big help in making hard decisions. It completely shuts out the irrational or nonquantifiable. It forces you to think clearly about the factors you consider and makes you decide on the importance of each one. Clear thinking is something all decision makers need. ■



Figure 5: The results of the foreign policy model show Economic Aid to be the best choice. Invasion is clearly not indicated.

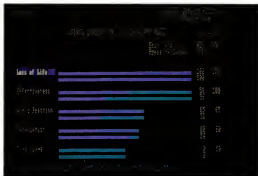


Figure 6: In this screen, the bars represent the weighting of each criterion, and the dark portions indicate each alternative's score.

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In just the last few months, *The NETWORK* has saved its members more than \$24,000,000 and processed over 100,000 orders.

Listed below are just a few of the over 20,000 products available at our **EVERYDAY LOW PRICES!** All software below is priced in IBM-PC format.

### The nation's largest corporations depend on PC NETWORK!

On our corporate roster are some of the nation's largest financial and professional concerns including some of the most important names in the computer industry:

|                              |                                 |
|------------------------------|---------------------------------|
| <b>AT&amp;T</b>              | General Motors                  |
| <b>Barclays Bank</b>         | Gillette                        |
| <b>Bell &amp; Howell</b>     | <b>Hewlett Packard</b>          |
| <b>Citibank</b>              | <b>Hughes Aircraft</b>          |
| <b>Columbia University</b>   | <b>IBM</b>                      |
| <b>Data General</b>          | <b>ITT</b>                      |
| <b>Exxon</b>                 | <b>Kodak</b>                    |
| <b>Farm Bureau Insurance</b> | <b>Multimedia</b>               |
| <b>Frontier Airlines</b>     | <b>Standard Oil of Ohio</b>     |
| <b>General Mills</b>         | <b>Yale University</b>          |
| <b>General Electric</b>      | <b>Veteran's Administration</b> |

plus thousands of satisfied consulting firms, small businesses, user groups, municipalities, government agencies and value-sensitive individuals **ACROSS THE NATION!** Their buyers know that purchasing or renting from PC NETWORK saves them time, money and trouble. They also count on us for product evaluation, professional consultation and the broadest spectrum of products and brands around.

## CALL TOLL FREE 1-800-621-S-A-V-E

**Your Membership Validation Number is A185**  
You can validate your membership number and, if you wish, place your first money-saving order over the phone by using your VISA, MASTERCARD or AMERICAN EXPRESS. Our knowledgeable service consultants are at your Mon-Fri 9 AM to 7 PM, SAT 9 AM to 5 PM CST.

**PERSONAL COMPUTER NETWORK**  
320 West Ohio  
Chicago, Illinois 60610

Call now... Join the PC NETWORK and start saving today!

## PRICING MADNESS

Once again, as Federal Express picks up our ad at the very last milliseconds before this issue's advertising deadline, here we **cut with dozens of price reductions and new product announcements which have arrived too late for us to tell you now.**

Why, our ad manager asks, do we always go through a last minute price update frenzy, just seconds before our ad is due at the publisher, when we know that despite our heroic effort, many of these products will **cost even less by the time you read this ad.**

How, she asks, can we get a crystal ball to forecast what fantastic promotions and specials our customers are going to offer from now to the date this ad gets to the newsstand over two months from today?

Well, we decided that she has a good point. While we'll still keep getting our gray hairs and ulcers from last minute revisions, we will start publishing this notice and ask our readers to make a simple check. Look at any four back issues of this magazine (yes we're in every one) and track the prices on the most popular products. You will see that many drop with every issue. Most of these price changes were instituted well before the issue was printed and our members **always** pay the **lower price.** This should prove that this notice is much more than hype.

Given the current madness in the PC industry with its spur of the moment pricing and instant product introductions, you will find it **always** pays to call for our **latest prices.** You will be glad you did.

### PC NETWORK

(Prices add \$2.50 shipping and handling for each title order from below.)

|                                                |          |                                                          |          |
|------------------------------------------------|----------|----------------------------------------------------------|----------|
| <b>Business Chess (Your Trained Dependent)</b> | \$ 34.99 | <b>Sceneplayer</b> (Anytime/Anyplace with mono-card box) | \$ 18.99 |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
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| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |
| <b>Chess</b> (Microsoft Office/IBM PC)         | 34.99    | <b>Share On Line</b> (Frogger)                           | 21.99    |

### BUSINESS SOFTWARE

|                              |          |                                     |      |
|------------------------------|----------|-------------------------------------|------|
| <b>ATI How to Use Manual</b> | \$ 42.99 | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
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| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |
| <b>ATI How to Use Manual</b> | 42.99    | <b>Lotus Development</b> (Symphony) | CALL |

### HARDWARE

(Prices add shipping and handling charges based on titles order from below.)

|                                      |            |                                      |            |
|--------------------------------------|------------|--------------------------------------|------------|
| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
| <b>Apple Macintosh</b> (Base System) | 1,500.00   | <b>Apple Macintosh</b> (Base System) | 1,500.00   |
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| <b>Apple Macintosh</b> (Base System) | 1,500.00   | <b>Apple Macintosh</b> (Base System) | 1,500.00   |

### COMPLETE SYSTEMS

|                                      |            |                                      |            |
|--------------------------------------|------------|--------------------------------------|------------|
| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
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| <b>Apple Macintosh</b> (Base System) | 1,500.00   | <b>Apple Macintosh</b> (Base System) | 1,500.00   |

### DISK DRIVES & CONTROLLERS

|                                      |            |                                      |            |
|--------------------------------------|------------|--------------------------------------|------------|
| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
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| <b>Apple Macintosh</b> (Base System) | 1,500.00   | <b>Apple Macintosh</b> (Base System) | 1,500.00   |

### MEMORY CHIPS

|                                      |            |                                      |            |
|--------------------------------------|------------|--------------------------------------|------------|
| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
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### MODEMS

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| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
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### MONITORS

|                                      |            |                                      |            |
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| <b>Apple Macintosh</b> (Base System) | \$1,500.00 | <b>Apple Macintosh</b> (Base System) | \$1,500.00 |
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### ACCESSORIES AND SUPPLIES

|                                      |            |                                      |            |
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### VIDEO CARDS

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### PC NETWORK

(Prices add \$2.50 shipping and handling for each title order from below.)

**BEFORE YOU BUY**—Members are eligible to join The NETWORK's Business and Game Software Rental Libraries and evaluate products for a full 14 (Regular) or 30 (VIP) days to see if it meets your needs. And the NETWORK's rental charges are far less than other software rental services—JUST 20¢ OF THE MEMBER WHOLESALE PRICE. We feature over 2,000 available titles in IBM, Apple, MAC and CP/M Formats.

# PC NETWORK • MEMBERSHIP APPLICATION

**YES!** Please enroll me as a member in the PC NETWORK™ and send my catalog featuring thousands of computer products, all at just 8% above DEALER WHOLESALe PRICES. I will also periodically receive "THE PRINTOUT", a special up-date on merchandise at prices BELOW even those in my wholesale catalog, and all the other exclusive, money-saving services available to Members.

I am under no obligation to buy anything. My complete satisfaction is guaranteed.

Please check (✓) all boxes that apply:

## • Basic Membership

- ☐ One-year membership for \$8  
☐ Two-year membership for \$15 (SAVE \$1)  
☐ Business Software Rental Library for \$25 add'l. per year—members only  
☐ Games Software Rental Library for \$10 add'l. per year—members only  
☐ Bill my credit card: ☐ VISA ☐ MasterCard ☐ American Express

## • Special V.I.P. Membership

- ☐ One-year membership for \$15  
☐ Two-year membership for \$25 (SAVE \$5)  
☐ BOTH Business and Game Software Rental Libraries for \$30 add'l. per year—V.I.P. members only

**A185**

Account Number:  Exp. Date:  mo. year

☐ Check or money order enclosed for \$

Name

Address  Apt. No.

City  State  Zip

Telephone (  )

My computer(s) is: ☐ IBM PC ☐ IBM XT ☐ IBM AT ☐ Apple II ☐ Macintosh ☐ Other

Signature ☒ (Signature required to validate membership) Copyright © 1985, PC NETWORK INC.

# PC NETWORK • MEMBERSHIP APPLICATION

**YES!** Please enroll me as a member in the PC NETWORK™ and send my catalog featuring thousands of computer products, all at just 8% above DEALER WHOLESALe PRICES. I will also periodically receive "THE PRINTOUT", a special up-date on merchandise at prices BELOW even those in my wholesale catalog, and all the other exclusive, money-saving services available to Members.

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☐ Games Software Rental Library for \$10 add'l. per year—members only  
☐ Bill my credit card: ☐ VISA ☐ MasterCard ☐ American Express

## • Special V.I.P. Membership

- ☐ One-year membership for \$15  
☐ Two-year membership for \$25 (SAVE \$5)  
☐ BOTH Business and Game Software Rental Libraries for \$30 add'l. per year—V.I.P. members only

**A185**

Account Number:  Exp. Date:  mo. year

☐ Check or money order enclosed for \$

Name

Address  Apt. No.

City  State  Zip

Telephone (  )

My computer(s) is: ☐ IBM PC ☐ IBM XT ☐ IBM AT ☐ Apple II ☐ Macintosh ☐ Other

Signature ☒ (Signature required to validate membership) Copyright © 1985, PC NETWORK INC.



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

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**BUSINESS REPLY CARD**

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First Class

Permit No. 14823

Chicago, IL

POSTAGE WILL BE PAID BY ADDRESSEE

**PC NETWORK**  
320 West Ohio  
Chicago, Illinois 60610



NO POSTAGE  
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IF MAILED  
IN THE  
UNITED STATES

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**BUSINESS REPLY CARD**

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Chicago, IL

POSTAGE WILL BE PAID BY ADDRESSEE

**PC NETWORK**  
320 West Ohio  
Chicago, Illinois 60610



## PC NETWORK

## CIRCLE 535 ON READER SERVICE CARD

# Test Your Microcomputer IQ\*

1. Name a totally integrated software package that was rated #1 by *Software Digest*. \_\_\_\_\_
2. Where can you buy an IBM PC XT or AT, AND have it installed, AND get on-site warranty for it? \_\_\_\_\_
3. Who will educate IC personnel or end-users at their site or yours? \_\_\_\_\_
4. What provides virtually any type of PC communications capability — from simple TTY to 3278/79 emulation? \_\_\_\_\_
5. What provides a micro software facility that allows you to customize a system to your specific requirements? \_\_\_\_\_
6. Who are the premier micro consultants to the *Fortune* 1350 companies? \_\_\_\_\_
7. Who has made the word hot-line obsolete, by staffing a full-service support center with computer professionals? \_\_\_\_\_
8. What is the easiest way for an IC manager to satisfy the many end-user needs in the organization? \_\_\_\_\_
9. What company's evolutionary approach to software and service (also demonstrated by NOMAD, now NOMAD2, the premier 4GL/DBMS) ensures that they'll be a major force in the micro marketplace for years to come? \_\_\_\_\_
10. Name the companies that can provide all of the above? \_\_\_\_\_

\*(Turn Page Upside Down for Answers)

1. DunsPlus Software 2. From DunsPlus 3. The DunsPlus Education Staff  
4. DunsPlus's Communications Utilities 5. The DunsPlus Tool Kit 6. DunsPlus's Professional Consulting Staff 7. The DunsPlus Support Center 8. Call DunsPlus at 800-DNB-PLUS 9. Dun & Bradstreet, the parent company of DunsPlus 10. DunsPlus

If you answered all of the above correctly, you've already solved most of the problems facing you. If not, give us a call at 800-DNB-PLUS, or write us at 187 Danbury Road, Wilton, Connecticut 06897.

**DunsPlus:**  
**An Innovation In**  
**End-User Computing**  
**From Dun & Bradstreet**

**DunsPlus**

**DB** a concern of  
The Dun & Bradstreet Corporation



LISP and PROLOG, now available on the PC, boast features that make them well suited to writing expert systems and other AI programs.

# The Languages of AI Research

**T**he stage is now set for a new generation of micro-based artificial intelligence software to emerge. With the appearance of such powerful desktop machines as the PC AT, personal computers now offer hardware support for both AI applications and sophisticated AI research. And the two primary AI languages, LISP and PROLOG, are now available for the PC.

Although successful AI programs can be written in other languages, LISP and PROLOG are designed to solve such problems as knowledge representation and natural-language processing. They appreciably cut programming time for many AI applications.

## LISP 101

LISP is the second oldest programming language still in use, and it's still going

strong. Through the years, LISP has undergone profound transformations with each major generation of programming methodology, and today it is as up-to-date as any of the newest languages.

From its inception, LISP offered an unusual, powerful combination of features. John McCarthy, its inventor, combined list processing, recursive programming (defining something in terms of itself), and extensibility (the ability to extend the language by defining new functions) to give the field of artificial intelligence research a powerful tool. In a field such as programming, where each degree of difficulty is a further barrier to simple, creative solu-



**Working** with LISP is in some ways a very different experience than programming in other languages, but the main concept of LISP is central to them all: lists.

tions, LISP has spawned entirely new avenues of approach. The heritage of other languages that offer the winning combination of recursive programming, list processing, and extensibility—such as Logo, PROLOG, and POP—can clearly be traced to LISP.

Working with LISP is in some ways a very different experience than programming in other languages, but the main concept of LISP is central to them all: lists.

A computer's memory is basically a list of addressable memory locations. Data files are essentially lists of data objects (mostly characters and numbers), and program code amounts to a list of instructions. Some programmers quip that LISP is an acronym for "Lots of Irritating Single Parentheses"; actually, it stands for List Processor, and its primary focus is on linked lists.

LISP's most important and unique feature is that both code and data have the same basic list representation. This means, first of all, that all of the list-processing functions can be used to operate on programs as well as on data, since a program in LISP is essentially a list of lists. Programs can thus operate on other programs and on themselves just as they operate on any other data. And, almost as a natural feature of the language, programs can be written to generate other programs.

For the same reason, data-driven programming is also very natural in LISP. With this feature, data and code can be combined, embedded, and then re-separated to produce any number of subtle and powerful effects. When a LISP system is in full operation, its patterns of continually shifting lists resemble a mobile network of strands of DNA molecules.

Although LISP is a high-level language by almost any standard, it resembles FORTH in that it can readily be molded into a variety of still higher-level languages. This is precisely how LISP is used today in major AI laboratories such as the

Heuristics Programming Project at Stanford: to create higher-level knowledge representation for expert systems.

### Intro to PROLOG

PROLOG, a relatively recent addition to the short list of AI programming languages, is receiving increasing attention as a tool for expert-systems programming, natural-language processing, and logical problem solving. It was invented in 1972 by Alain Colmerauer and his associates at the University of Marseilles, who wrote the first PROLOG interpreter in the ALGOL-W language. Then, in 1975, Colmerauer's colleague P. Roussel implemented a better and more efficient interpreter in FORTRAN. However, PROLOG didn't attract widespread interest until David Warren's very efficient implementation in 1979 on a DEC-10 computer at the University of Edinburgh. This implementation, known as DEC-10 PROLOG, or Edinburgh PROLOG, included the first PROLOG compiler.

Some large AI applications have already been written in PROLOG. The Mecho program, written by Bundy, Mellish, and others in 1979 at the University of Edinburgh, solves mechanics problems that are stated in English. The Chat system by Warren and Pereira answers highly specific questions posed in English, about international geography. And the ORBI expert system by Pereira, Sabatier, and d'Oliveira at the New University of Lisbon in Portugal makes expert environmental resource evaluations.

PROLOG is also being used for industrial applications, particularly in Hungary, where it has received sponsorship from the Hungarian government. Other applications include semantics, planning, architectural design and site planning, logistics, solving symbolic equations, and biochemical analysis and drug design.

The language's name is derived from the phrase "PROgramming in LOGic."



and logic is a crucial factor in PROLOG: It allows you to use symbolic logic to write programs. Anyone familiar with programming will immediately recognize the problem with that. Normally you write programs by telling the computer the exact operations it is to perform. But formal logic is a general-purpose language for making precise, descriptive statements.

### Symbolic Logic

PROLOG is a descriptive or relational language, whereas most other computer

languages are procedural. With a descriptive language, instead of programming procedures, you carefully describe the details of a problem, and the language uses its procedures to try and solve it for you. This sounds more like an application program than a programming language, and in some ways PROLOG is like a very high-level application. The crucial difference is that PROLOG's application is that of solving problems in logic, a symbolism that can be used to describe almost anything, whereas most application programs

deal with very specific problem areas.

Formal logic (also known as propositional calculus) uses letter variables to represent propositions and symbols to express the logical relations between those symbols. For example,  $P \vee Q$  (read: Not P or Q) could symbolize a statement such as "Either you are going to stop shouting or I'm going to have to leave." PROLOG, on the other hand, is based on what is known as predicate calculus, a more powerful symbolism that can be used to represent the logical relations between things

## PROLOG

is loaded with subtleties that can either work for you or against you, depending on how well you understand them.

and their attributes. PROLOG can, for instance, be used to represent such classic logical syllogisms as:

```
All egotists are bores.
Mr. Graham is an egotist.
Therefore Mr. Graham is a bore.
```

In PROLOG, you might represent this as the following:

```
bore(Person) :-
 egotist(Person).
egotist(mr.-graham).
```

After that, by entering the query `bore(X)`, you would arrive at the following conclusion:

```
X = mr.-graham
```

An inherent feature of any version of PROLOG is its deductive database, which is ready to store any information that falls into one of two basic categories: facts and rules. In the above example,

```
bore(Person) :-
 egotist(Person)
```

is a rule, and

```
egotist(mr.-graham)
```

is a fact.

You are not required to issue many special commands to use the database; PROLOG is not an imperative or procedural language. Any syntactically correct statement, query, or command made to the PROLOG interpreter automatically becomes an entry in the database. (PROLOG's commands are the concessions made, apparently almost grudgingly by the real purists, to the procedural programming approach.)

PROLOG's deductive database comes equipped with a problem-solving method, which the database describes. You give problems to PROLOG to solve by directing queries to the interpreter in a form similar to algebra. In effect, you ask PRO-

LOG what X's there are such that certain conditions are satisfied, as in the example above containing the query

```
bore(X)
```

PROLOG responds by reasoning backward to find values for the variables of your query such that all of the query's conditions become consequences of the defining entries stored in the program/database.

Whenever it responds to its standard query primitives, PROLOG follows the same basic search procedure. It moves in a top-down and left-to-right fashion through all of the clauses that have been entered in its database, matching the query conditions with each entry. When it finds a match, any preconditions of the matched clause pose a new query that PROLOG has to solve to provide the solution for the matched condition. Unless told to do otherwise, PROLOG searches for *all* the solutions to a given condition. Once it has found one answer, it backtracks and keeps going through the entries until it has exhausted all possibilities for matches. Then it goes on to the next condition and finds all the solutions that satisfy it, and so forth until all solutions are found for all conditions.

The way in which you enter your initial information and pose your queries obviously determines how much searching PROLOG has to do before it returns its results. When rules are part of the database, PROLOG always applies them in the order you entered them. When it responds to compound queries (those with more than one condition) it always takes them in order from left to right. This means that the order in which you enter conditions plays a big part in how quickly and efficiently PROLOG operates. It's generally good practice to first specify those search conditions that will rule out the most possibilities so that PROLOG keeps its redundant searching to a minimum.

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PROLOG is loaded with subtleties that can work for you or against you, depending on how well you understand them. On the bright side, PROLOG can be an efficient way to solve problems for programmers who know what they're doing. For the uninitiated, however, it can seem like an incomplete application program that you must finish, but without being able to see the source code.

The versions of LISP and PROLOG now available for the PC can accommodate a full spectrum of users, beginner to advanced. They fall naturally into three groups: those suitable for newcomers to the languages who want a system mainly for educational and exploratory purposes, those suitable for many professional applications, and those with particularly advanced features that embody state-of-the-art ideas in LISP and PROLOG programming. Following are brief discussions of LISPs and PROLOGs for the PC.

### For the LISP Student

LISP/88 was created primarily with the intention of making a version of LISP available at a moderate cost for students of the language. It is modeled on and is a small subset of the INTERLISP dialect. LISP/88 includes 83 functions, quite a sufficient number for becoming acquainted with the language. The package includes two demos of the type of program that can be written with the system: simple versions of DOCTOR (a version of the well-known psychology program Eliza), and ANIMAL, a simple classification game. LISP/88 even includes a garbage collector (a memory management function that allows you to reclaim memory in the system that is no longer being used), an essential feature for developing large programs; it is surprising to find this feature in a LISP that is implemented to use only a small memory space. It also has a structure editor, which is similar to a line editor, but accesses parts of a program on the basis of

## LISP or PROLOG?

Each of the two languages has its strong and weak points. In some cases, the wisest choice is to use them together to get the best of both.

How do you choose between LISP and PROLOG for a given application? Let's assume that the programmers involved either have equal knowledge of both languages or are familiar with neither.

If graphics, carefully designed screen formats, or I/O features are important factors in an application, LISP is almost always a better choice. So far, PROLOG systems have little or no I/O capabilities; this lack is one of the drawbacks of a language that attempts to be purely descriptive. The necessary I/O capabilities can be added, of course, along with an interface to routines written in assembly language. However, it is not always appropriate to make such a substantial development effort in machine-dependent code.

If memory space is an important factor, PROLOG is more appropriate. Some existing applications in PROLOG require considerably less memory than corresponding applications in LISP. However, keep in mind the difference between the size of the interpreter and application files and the amount of space needed for the application to run. Although the size of the PROLOG files will nearly always be smaller, often the memory needed by a PROLOG program to function is considerably more than a corresponding LISP program. This discrepancy is due to PROLOG's backtracking search procedure, which has to be kept carefully under leash to keep

time and memory usage within acceptable boundaries.

Of the two languages, LISP is more readable and easier to maintain because the code tells the full story. With PROLOG, it is not sufficient just to read the code—you must infer how the code will cause PROLOG's inferencing procedure to perform on the existing database.

Even though a PROLOG program is a working system at every stage of its development, it is not nearly as easy with PROLOG as it is with languages like LISP and FORTH to experiment your way to brilliancies. To really get a PROLOG program to use the system efficiently requires an application that's been very carefully planned from the top down and from the bottom up. The order of every part of a PROLOG application is very important, whereas the order in which functions, data, and rules are entered into a LISP system does not noticeably affect its efficiency.

Still, PROLOG can be very good as a prototyping language. This means that it takes considerably less time to get a sample version of an application running in PROLOG than in LISP. The cut in development time could even carry through to the project itself. Because the development time may be far less in PROLOG, it may be worthwhile to see if experienced PROLOG programmers can find a successful approach to a problem fairly rapidly. If not, you can make a

(continued)



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(\*) Benchmark run on an IBM PC using MS Pascal version 3.2 and the DOS linker version 2.6. The 176 line program used is the "Gauss-Seidel" program of Alan R. Miller's book: *Pascal programs for scientists and engineers* (Byte, page 100) with a 3-dimensional non-singular matrix and a relaxation coefficient of 1.0.

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the structure of symbolic LISP expressions (called *S-expressions* in LISP) rather than by line, word, or character. In the hands of an experienced LISP programmer, a structure editor can be a powerful tool, but many accomplished LISP programmers still prefer a full-screen editor. You can

use other editors to prepare LISP text files, but you would have to be outside the LISP system to use them.

Although it includes some very useful features, LISP/88 does lack some important functions such as ASSOC, DO, IF, LET, and SUBST. It also lacks macros.

(LISP or PROLOG? continued)

more time-consuming attempt in LISP.

## Double Duty

If a clear-cut choice between LISP and PROLOG doesn't present itself, it is possible to use both languages in a single application. There are two ways to do this. One is simply to use a function that can call and run externals. Many LISP systems offer this capability, and soon some PROLOG systems will as well. With this method, you can design complex architectures for applications that use PROLOG for some parts and LISP for others and call one another as the need arises.

The other way to use both is with one of the many PROLOG-in-LISP systems available, some of which contain very impressive features. In such a system, PROLOG essentially becomes a function, or "verb," in LISP. This gives you the choice of "prologging" a solution to a given problem. The biggest drawback with a PROLOG-in-LISP is that it is often quite slow, but it offers considerable advantages as well. By far the most important one is that the whole LISP system, with all of its features, can often be made available from within the PROLOG function. This availability is particularly important because PROLOG's list processing is very rudimentary—all the powerful list-processing functions that have evolved over the years in the LISP environment are not there. While it's certainly possible to implement some of these functions in PROLOG, it requires a

major development effort to implement even a modest subset of them.

LISP has evolved gradually over a long period to reach its present form. It has already passed through the "LISP machine phase" and has now stabilized with the Common LISP standard, a surprisingly mature and progressive standard. On the other hand, while Edinburgh, or DEC-10, PROLOG has become a de facto standard, this situation may change dramatically when Japan announces its first microcomputer PROLOG machines in the near future. The advance publicity indicates that Japan is developing a "prolog with a small 'p'" —a PROLOG-type system with many new and important features, including the built-in capacity for parallel and distributed processing. Whatever the nature of the implementation, the "PROLOG machine phase" is now just beginning, so there will be little hope for a true PROLOG standard for some time to come.

Because microcomputer PROLOG is still very much an open proposition, it will be quite a challenge for it to compete with LISP, given the enormous momentum that LISP has already achieved. LISP is a general-purpose language that can absorb new features into its environment, whereas for the time being, PROLOG can be considered only a special-purpose language. In the foreseeable future, it is highly unlikely that PROLOG, the new kid on the AI block, will dethrone LISP as the AI language of choice.

—E.T.

One of the first things you may want to do with LISP/88, therefore, is to try to implement some of the more common LISP functions that are absent. Figure 1 shows a definition in LISP/88 for the ASSOC function.

For its price, LISP/88 is surprisingly well packaged, easy to use, and appropriate for LISP students. However, it is not suitable for learning the advanced LISP programming techniques needed for AI research.

BYSO LISP is another LISP that was developed primarily with the student in mind. It claims to be fully compatible with the LISP 1.5 dialect and includes a library that can make it compatible with a small subset of MACLISP (a standard dialect of LISP that is an extension of McCarthy's work). The additional MACLISP functions include FUNCALL and the DO and LET macros. When you invoke MACLISP compatibility, the other functions in the system also become MACLISP-compatible.

The main limitations of BYSO LISP are that it is capable only of integer arithmetic and has no Boolean functions, comment facility, BREAK function, or backtrace. Since the manual mentions no garbage collector and no function to invoke it, the system apparently does not have it. Arrays, however, are included, and in all there are about 175 functions and special forms in this LISP.

Although BYSO LISP is not as well packaged and documented as some of the other LISPs, it has already been updated and enhanced several times. And because the author, a young LISP enthusiast named Raphael Levien, created the system for his own use, we can expect that improvements and enhancements will continue to appear for some time. In my opinion, the implementation of a garbage collector would be a key element in making this a more complete implementation.

XLISP is a tiny experimental LISP written in C by David Betz for studying object-oriented programming concepts. It is in the public domain and can be obtained for \$7 (the price of the disk and shipping). Included is a tiny PROLOG-in-LISP that is written with just 10 functions in XLISP. This miniature PROLOG runs very slowly and has only the barest minimum of features, but it allows you to enter and query the deductive database that is the heart of a PROLOG system.

Another interesting feature is the use of the ANSI terminal driver to implement turtle character graphics. XLISP contains about 75 functions (mostly in the MAC-LISP dialect), of which about 10 or so are related to an object-oriented class system. You may want to look into a newer version of XLISP (version 1.4) that has an increased number of functions.

XLISP's documentation is minimal, but with some programming knowledge and a good book on LISP, it can be a very inexpensive way to try out a version of the language with some up-to-the-minute concepts before investing in a more complete (and expensive) system.

### Professional LISPs

QLISP was one of the first versions of LISP available for the PC, and some interesting applications have been written in it, including the expert system KES (Knowledge Engineering System) and the Expert Development System for the TI Personal Computer. IQLISP was written especially for the PC and makes special use of vari-

ous features of the PC environment. The most important of these is the language's ability to address the full memory space of the PC.

I was particularly impressed with IQLISP's ability to handle unusually large integers in its math functions. I implemented a function that raises an integer to a chosen power to find out the largest number the system could handle, but I gave up trying after the program filled several screens with numbers as the digits of a single gigantic integer.

All in all, IQLISP offers quite a bit for the money. It has floating-point support if the 8087 chip is present, and a software floating-point package if it isn't, point and line graphics, window support, and a pretty printer (which prints with the proper indentations to indicate the LISP program's structure). The SELECTQ, FOR, REPEAT, LET, :=, and LOOP macros for structured programming are also included in the library of functions defined in LISP.

The next version of IQLISP to be released will feature the long-awaited IQLISP compiler. Since this version will offer greater compatibility with Common LISP, the LISP standard that has evolved, the compiler will not directly accept source files from previous versions. However, the intention is to include tools that will aid in automatic conversion of applications written in the earlier system to 2.0-compatible source files.

MULISP/83, Version 4.11, is the most recent release of an implementation of

```
DEFINE (((ASSOC (VARIABLE +LIST)
 (COND ((EQ VARIABLE (CAR +LIST)) (CAR +LIST))
 (T (ASSOC VARIABLE (CDR +LIST)))))))
```

**Figure 1:** LISP/88 lacks some important functions such as ASSOC. Given how useful they are, you may wish to implement them yourself.

**With** well over 250 functions, the dialect implemented by TLC LISP is one of the most progressive available for the microcomputer.

LISP from The Soft Warehouse that has been available for a number of years and on several different microcomputers. The system includes an integrated development package called MUSTAR that contains editing and debugging tools, a pseudo-code compiler, and source code for both MACLISP- and INTERLISP-compatible extensions. The built-in functions include CATCH and THROW control primitives, low-level machine code interrupts, the LOOP macro, and an EXECUTE function for running external programs. Also included are several demos including the games DOCTOR, ANIMAL, HANOI, and METAMIND (a version of *Mastermind*).

MULISP's editor is an unusual one that cannot be categorized as a screen editor, line editor, or structure editor. Like a line or structure editor, it does not immediately display all the text in a disk file starting from the top. When the MUSTAR development environment is loaded, a menu is displayed that lists the separate options required for editing functions, variables, and properties. When you choose one of these options though, you can select the names of as many items as desired, and they will be pretty-printed in indented format for ease of reading, with the cursor positioned at the beginning.

Once the desired items are displayed, they can be accessed by cursor movement keys just as in any full-screen editor. The advantage of this type of editor is that you only need to display those items you want to work on; you don't have to move through the rest of the text to get where you want. The disadvantage is that you don't get to see the whole file as it actually will appear.

MULISP lets you add machine language subroutines if you find them necessary. They are needed for applications in which you must add more I/O capability, if you want to add lower-level functions directly to the system, or if you need faster

performance for a key MULISP function. Generally this feature can only be used by programmers who know both MULISP and assembly programming well. The documentation contains examples and all the information needed to make the implementation with the system.

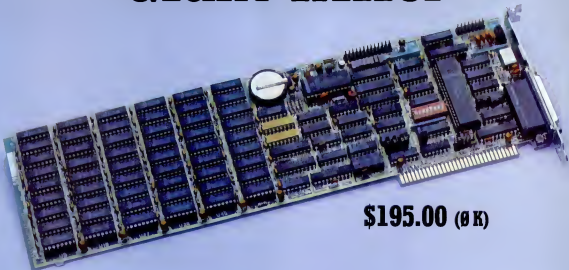
### Advanced LISPs

TLC LISP, by John Allen from The LISP Company, is an advanced system in several respects. First of all, it comes with a compiler that can compile LISP functions into p-code, which results in a noticeable increase in speed. Also, the dialect implemented by TLC LISP is one of the most progressive available for microcomputers; it includes well over 250 functions, more than 50 of which are compatible with Common LISP. The cornerstone of this system, though, is an object-oriented class system. The graphics extension (which is included) offers a multiple turtle capability (like that of Logo, but with the capacity to operate more than one turtle simultaneously and independently) and rounds out a very well-crafted implementation.

Superficially, TLC LISP looks like UCI LISP (with MACLISP and INTERLISP, a third de facto standard dialect). However, in other respects it is very similar to MACLISP. One of the nicest features of the TLC LISP programming environment is its powerful full-screen editor that is function-compatible with *WordStar*. This means that most programmers will be able to get right down to writing programs rather than having to take time to learn a completely new editing system.

Like many of the more progressive LISP editors, this one has a handy feature that allows you to evaluate your functions while still in the editor to check for obvious syntax errors, unpaired parentheses, and other minor mistakes. Like most LISP editors, this one is written in LISP (and, in this case, compiled into p-code) and may be called from within the programming

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## LISP AND PROLOG

environment so that you don't have to reload the LISP interpreter to test the code after an editing session.

TLC LISP's documentation is outstanding. It's intelligibly written and includes a masterful introduction that

makes an excellent LISP primer. Its reference section includes numerous examples and listings that often show the equivalent high-level LISP code for various TLC LISP primitives.

The compiler is not very well docu-

mented in the version I tested, but it can compile most of the TLC dialect, is quite easy to use, and often produces p-code files that are even smaller than their parent LISP files. One very nice bonus is that the source code for the editor is included,

### The Book of LISPs (and PROLOGs)

The two primary AI languages, LISP and PROLOG, are now available for your PC. Here are some of the implementations currently on the market.

#### **BYSO LISP**

Levien Instrument Co.  
P.O. Box 31  
McDowell, VA 24458  
(703) 396-3345

List Price: \$125

Requires: 128K RAM, one disk drive.

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#### **Golden Common LISP**

Gold Hill Computers  
163 Harvard St.  
Cambridge, MA 02139  
(617) 492-2071

List Price: \$495

Requires: 512K RAM, one double-density disk drive, DOS 2.0.

CIRCLE 738 ON READER SERVICE CARD

#### **IQLISP**

Integral Quality, Inc.  
P.O. Box 31970  
Seattle, WA 98103  
(206) 527-2918

List Price: \$175

Requires: 192K RAM, one disk drive, DOS 2.x.

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#### **LISP/88**

Norell Data Systems  
3400 Wilshire Blvd.  
P.O. Box 70127  
Los Angeles, CA 90010  
(213) 257-2026

List Price: \$49.95

Requires: 64K RAM (128K recommended), one disk drive, 80-column display, DOS 2.x.

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#### **Micro-PROLOG**

Programming Logic Systems, Inc.  
31 Crescent Dr.  
Milford, CT 06460  
(203) 877-7988

List Price: \$295

Requires: 128 RAM, one disk drive.

CIRCLE 735 ON READER SERVICE CARD

#### **MULISP/83**

Microsoft Corp.  
10700 Northup Way  
Bellevue, WA 98004  
(206) 828-8080

List Price: \$250

Requires: 64K RAM, one disk drive, DOS 2.x.

CIRCLE 734 ON READER SERVICE CARD

#### **PROLOG-1**

Expert Systems International  
1150 First Ave.  
King of Prussia, PA 19406  
(215) 337-2300

List Price: \$395

Requires: 128K RAM, one disk drive, DOS 2.x.

CIRCLE 733 ON READER SERVICE CARD

#### **PROLOG-86**

Solution Systems  
335 Washington St.  
Norwell, MA 02061  
(617) 871-5435

List Price: \$125

Requires: 128K RAM, one disk drive, DOS 1.1 or higher.

CIRCLE 732 ON READER SERVICE CARD

#### **TLC LISP**

The LISP Company  
P.O. Box 487  
Redwood Estates, CA 95044  
(408) 354-3668

List Price: \$250

Requires: 128K RAM (256K recommended), one disk drive, DOS 2.x.

CIRCLE 731 ON READER SERVICE CARD

#### **XLISP (Disk #148)**

Public Domain S.W.  
1400 Coleman Ave., Suite C18  
Santa Clara, CA 95050  
(408) 988-0164

List Price: \$7

Requires: 128K RAM, one disk drive, DOS 2.x.

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# finger friendly



ff5151 \$159

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**Do you love your PC, but hate its keyboard?** No need to listen to that irritating click-clack, click-clack noise. We now offer two low-cost alternatives, our ff5150 priced at \$129 and our ff5151 at \$159, to the standard IBM keyboard. Our keyboards replace the audio feedback of the IBM keyboard with touch feedback through your fingers.

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Our ff5151 is the keyboard for business PC users. By separating the cursor control cluster from the numeric key cluster, spread-

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**Like** most PROLOG systems, PROLOG-86 is very limited in its number-handling ability. However, this system is generally very fast in its execution.

which is not only an excellent example of TLC LISP programming style but allows programmers to customize the editing environment to add those features they want and then recompile it for fast execution.

Golden Common LISP, an implementation by Golden Hill Computers, is the first Common LISP lookalike on a micro-computer. Although it contains many of the characteristic Common LISP functions and function names, there is an important difference between this version and the Common LISP standard that LISP aficionados will notice immediately: Common LISP is supposed to be lexically scoped, but, though the company intends to implement lexical scoping, Golden Common LISP still has dynamic scoping.

The highlights of this system are the GMACS editor (a version of the very powerful and popular editor EMACS), the lavish two-disk tutorial called Explorer, and a substantial number of Common LISP-compatible functions that include some advanced features previously available only on LISP machines: stack groups, multivalued variables, coroutines, and generalized variables. Other useful features include extensive on-line help facilities and a tracer and stepper for debugging. Golden Common LISP supports the DEFSTRUCT function, which lets the programmer create databases with as many fields as needed with a single function. By overlapping and dovetailing fields, these data structures can be made highly relational.

This extremely well-packaged system comes with a copy of the second edition of the book *LISP* by Patrick Winston and Berthold Horn, and some of the most important examples in the book are implemented in the Explorer tutorial system, ready to load and experiment with. The tutorial is designed for a very broad range of LISP programming levels; the earliest lessons presume no knowledge of LISP

programming whatsoever, but even accomplished LISP programmers can skip to the advanced lessons and find something interesting there.

### PROLOGs for the PC

PROLOG-86, Release 1.11, is an implementation of PROLOG intended primarily for those who are interested in learning the language. Its limitations are not so much in the size and quality of the interpreter as in the size of the applications that can be produced with it. PROLOG-86 is a major subset of David Warren's Edinburgh PROLOG.

Like most PROLOG systems, PROLOG-86 is very limited in its number-handling ability. The highest number integer that could be handled by the prime number program, even when the maximum amount of memory was made available, was 166. However, this system was generally very fast in execution. It found the prime numbers between 1 and 150 in less than half the time it took PROLOG-1 (see below).

Micro-PROLOG is a surprisingly well-equipped version developed by Logic Programming Associates Ltd. of London. It was designed originally for Z-80 systems running CP/M and later ported to the IBM PC. Its highlights are its floating-point math, full trace, and spy-point debugging facilities, an easy syntax module called Simple, an Edinburgh PROLOG simulator, and an assembly language interface. An additional enhancement is the module-wrapping feature that allows you to break up large programs into segments that can be debugged separately and split between resident RAM, disk, or RAMdisk. Micro-PROLOG is written mostly in assembly language and is reasonably fast, as long as the problems it is assigned are of modest complexity.

Essentially, Micro-PROLOG has implemented a small PROLOG core of about 25K onto which you can load various





# One-Write Plus: Variations On an Accounting Classic

Small-business users who swear by manual one-write systems now have a first-rate, computerized alternative.

**B**ookkeeping is a rigorous, time-consuming task, and the term "double-entry bookkeeping" implies having to put forth twice the effort. So some time ago—before personal computers became widely available—an imaginative entrepreneur (probably a frustrated accountant) devised a special means of organizing records to eliminate some of the redundancy of everyday accounting chores: the one-write accounting system.

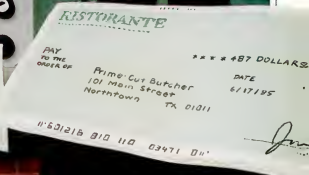
The one-write system reduces the number of tasks necessary to keep a set of double-entry accounting records. The system uses a special type of check that has a carbon strip on its back, and a cash disburse-

ments journal with a pegboard apparatus to ensure proper alignment (see Figure 1). "One writing" produces the actual check while the image made by the carbon strip on the back of the check simultaneously updates the cash disbursements journal. This system has been implemented and marketed in many variations by such companies as Safeguard, McBee, Burroughs, and NEBS. In fact, it is estimated that some 5 million small businesses and professionals use such systems.

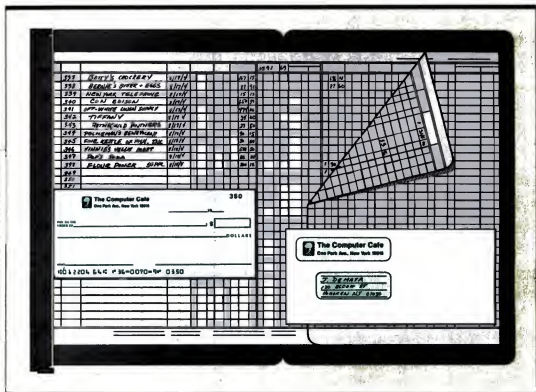
The staff of the Melanson Professional Association of Nashua, New Hampshire, decided that the simplicity of a one-write system could be computerized and anti-



# RISTORANTE



WELCOME



**Figure 1:** An illustration of the manual one-write accounting system.

pated a significant market for such a product. In fact, they saw an immediate need for an automated one-write system for their own clients to use. They created SteppingStone Software, Inc., to develop the software and engaged Evergreen Software to market it. Last fall, Evergreen

**PC** **Evergreen**  
One-Write Plus, General Ledger  
Evergreen Software, Inc.

**The Meeting Place**  
Amherst, NH 03031  
(603) 673-0830

**List Price: \$295**

**Requires:** 128K RAM, two disk drives.

CIRCLE 397 ON READER SERVICE CARD

introduced SteppingStone's low-priced, easy-to-use accounting software package, called One-Write Plus, for the IBM PC and compatibles. The core (*General Ledger*) module of One-Write Plus was the first to be released; the *Accounts Receivable*, *Accounts Payable*, and *Payroll/Personnel* modules should be available this spring.

If the daily accounting work of your small business or professional practice consists mainly of recording cash disbursements and cash receipts and you're looking for an easy-to-use program with well-balanced, practical features, One-Write Plus may be just right for you. It effectively emulates classic one-write, or pegboard, accounting systems.

## Involving Your Accountant

One-Write Plus is a natural stepping-stone from a manual accounting system to a micro-based system. However, its designers recognized that many small-business operators rely heavily upon an accountant or bookkeeper for advice on how to record transactions and prepare reports. Implementing a PC-based accounting system involves more than simply automating the processes of recording and summarizing transactions. You need to understand something about accounting to properly set up and maintain the accounting records. The developers of One-Write Plus assumed that you may require assistance from your accountant in setting up your books. They even included

## ONE-WRITE PLUS

a booklet titled *For Your Accountant* as the first section of the manual.

More than any other system Price-Waterhouse has reviewed, One-Write Plus emphasizes the importance of the accountant's role in automating your accounting records. The documentation suggests that your accountant or bookkeeper help set up

---

One-Write Plus is a natural stepping-stone from a manual accounting system to a micro-based system.

---

and customize your One-Write Plus system and oversee your daily and, in particular, your monthly accounting activity. The system's special features and safeguards will minimize errors and retain enough flexibility to make your accountant's job faster and easier, which saves you money.

### Installation

One-Write Plus is designed for computer novices. Accordingly, its developers made the installation procedures as simple as possible. The documentation includes a basic discussion of the PC's keyboard, system backup procedures, and system disks.

The package contains four disks: working and backup copies of the Daily disk, a Monthly disk, and a Utility disk. The DOS files that customize these disks are automatically installed with DOS command batch files. You must also create a data disk in which to store your company's financial information. Figure 2 shows how the four disks function within the One-Write Plus system. Once your disks are formatted, you can bring up the system by rebooting or typing "Start" with either the

# How Do I Choose the Right Personal Computer Monitor?



## ONE-WRITE PLUS

Daily or Monthly disk in drive A: and your data disk in drive B:

Installing One-Write Plus on the hard disk of a PC-XT is equally straightforward. The programs take up about 800K on the hard disk and are stored in a sub-directory that is automatically created by the installation program. You are given the choice of storing your company's data on a floppy or hard disk. The hard disk can hold data for only a single company in the same volume as the program. However, by keeping records on different floppy disks, accountants could use One-Write Plus to process data for many different companies. According to the system documentation, each floppy disk can store up to about 2,000 transactions. Transactions are summarized at the end of each month, so this capacity should be enough for most small businesses.

After you start the One-Write Plus system, the first screen asks you whether you will be using a color or monochrome monitor. Unfortunately, this selection cannot be saved for your configuration and must be made each time you format the system. The software does make very effective use of color in presenting its journal-like screens.

The program makes effective use of the function keys. For example, the F10 key moves you back one menu level, and the F9 key provides context-sensitive help messages, which novices should appreciate.

### One-Write Plus software makes very effective use of color in presenting its journal-like screens.

ate. No function key overlay template is included, but this shouldn't be too great an inconvenience since you are continually informed of your options on the bottom line of the screen.

#### Customizing Your Ledger

Once you've logged on to the system, you will come to the Master Menu (see Figure 3). Your first concern will be the setup procedures. After entering your

company name and address, you can start setting up your chart of accounts. One-Write Plus provides you with two predefined choices. The Complete Chart has 95 commonly used financial accounts while the Partial Chart has only 6. In most cases, it makes sense to begin with the Complete Chart and then add, modify, or delete accounts to meet your needs. Your chart is limited to 250 accounts, each with a four-digit account number—ranging from 1000 to 9999—and a title of up to 25 characters. Departmental subaccounts are not available.

In order for your reports to make sense (since they are predefined by the system), you must make sure that your account numbers fall within the appropriate fixed range. The 13 account ranges are:

|           |                            |
|-----------|----------------------------|
| 1000-1499 | Current Assets             |
| 1500-1699 | Property and Equipment     |
| 1700-1999 | Other Assets               |
| 2000-2499 | Current Liabilities        |
| 2500-2999 | Noncurrent Liabilities     |
| 3000-3999 | Equity                     |
| 4000-4299 | Sales                      |
| 4300-4999 | Cost of Sales              |
| 5000-5999 | Selling Expenses           |
| 6000-6999 | General & Administrative   |
| 7000-7199 | Other (Income) and Expense |
| 7200-7299 | Income Taxes               |
| 9995-9999 | Special Accounts.          |

For example, if you want your inventory account to fall within the balance sheet classification of Current Assets, it has to be numbered between 1000 and 1499. This type of restriction is not uncommon for low-end systems.

Once you modify the chart of accounts to fit your needs, you must enter your control accounts for cash, equity, accounts receivable, accounts payable, and inventory. These control accounts help One-Write Plus convert your daily single-entry records into double-entry general-ledger transactions for your financial reports. You can enter up to three cash-control accounts, allowing you to use three separate checking accounts.

Once you have set up your accounts,

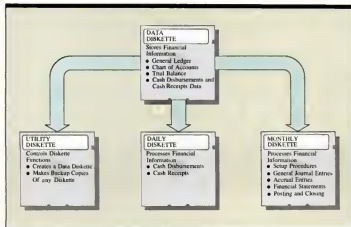


Figure 2: This representation from the One-Write Plus documentation shows how the four program disks work together with the data disk to create and store financial information.

## ONE-WRITE PLUS

you can establish your initial account balances, including your initial trial balance. The menu provides a "Load Starting Trial Balance" facility for this task. The system maintains running totals of your debits and credits. It won't allow you to post an out-of-balance trial balance. While it is possible to post your trial balance before getting a hard copy for audit trial purposes, the sequence of the menu selections and the documentation indicate that a printout should be generated before posting.

When you chose the default chart of accounts, the system also establishes default column headings for your cash disbursements and receipts journals. These headings are similar to those you would establish at the top of a manual one-write system to enable you to distribute your receipts and disbursements to the proper accounts. If you use more than one checking account, you must assign column headings for each account. In addition, when you make changes to the chart of accounts, you receive a message reminding you to change any corresponding column headings. Changes to the accounts do not automatically flow through to the journal headings. It's easy to modify your column headings so they'll be easy to find when you're making a distribution. As with manual systems, each journal contains a limited number of columns (One-Write Plus has 25) that are intended for the most commonly used accounts. You can, of course, distribute to any financial account by entering the appropriate account number. The entry shows up in one of five "miscellaneous" distribution columns.

### Daily Accounting Chores

For many small businesses, recording and managing cash makes up the majority of the daily accounting workload. With One-Write Plus, in addition to posting your cash disbursements and cash receipts journals and printing checks, you can get an up-to-the-minute report of your cash position.

Working with the cash disbursements

# Will It Work with My PC?

Before you can experience the full capabilities a high performance monitor offers, it has to work with your personal computer. That's why Princeton Graphic Systems makes high resolution monitors compatible with most popular brands of personal computers. IBM, Compaq, Corona, Apple and more. But we go one step further. By paying close attention to ergonomic detail, we make Princeton Graphic Systems monitors compatible with you, the computer system user...





## ONE-WRITE PLUS

functions, you can use the computer to print your checks or you can record hand-written checks. The system's cash disbursements screen looks just like a familiar one-write ledger. It graphically displays a check to be filled out by the user. The check overlays the left-hand portion of the cash disbursements journal just like most manual one-write systems (see Figure 4). This function employs some of the best accounting software graphics around.

Check numbers can be automatically assigned or manually entered. The system accommodates amounts up to a penny shy of \$1 million. Up to 25 alphanumeric characters on each of four lines are available for a payee's name and address.

After you fill out each check, One-Write Plus performs the account distribution (classification of the purpose of the expenditure) in the screen's two right-hand columns. You can scroll through the accounts until you find the one to which you want to distribute all or a portion of the expenditure. You can also zoom right over to the proper column by typing in the account number when prompted. You can distribute an expenditure to a maximum of six columns per check. This should be plenty for most transactions. Once your distribution is in balance, you can save the transaction and move on to the next disbursement. The cash balance, which is shown in the upper right corner of the screen, decreases by the amount of each check that is written.

Computer-generated checks must be consistent with the dimensions and format required by One-Write Plus. The manual recommends several forms vendors that offer appropriately formatted checks. You can easily void checks and edit them too. However, you are only able to edit the check memorandum field and distribution account(s) on a computer-generated check.

Two reports are provided for cash disbursements, and they allow you to send output either to your screen or your printer. The Check Register lists each check

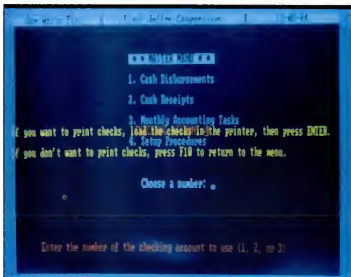


Figure 3: Here is the One-Write Plus Master Menu screen. The first two selections require the use of programs on the Daily disk; the programs on the Monthly disk are needed to execute menu choices 3 and 4.

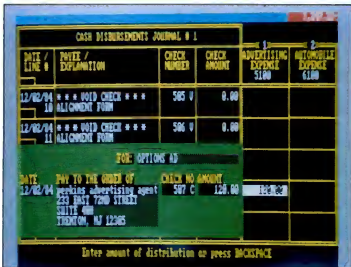


Figure 4: This screen is used for recording computer-printed checks. After you fill in all the information on the face of the check, the cursor highlights the account number in the first of the two columns on the right. The running cash balance in the upper right corner helps to keep you from overdrawing the bank account.



## ONE-WRITE PLUS

with its dates, payees, memoranda, and amounts. The cash disbursements' Distribution Report lists disbursement information by general ledger account. Accounts are listed in numerical order.

Cash receipt transactions are handled in the same manner as cash disbursements. Cash receipts are recorded with a nicely

Cash receipts are recorded with a nicely formatted screen that visually represents a manual cash receipts journal.

formatted screen that visually represents a manual cash receipts journal. And, analogous to the printing of checks, bank deposits can be recorded to reflect the deposit of all recent cash receipts. When you choose to record a bank deposit, One-Write Plus automatically totals all of the receipts recorded since your last deposit and adds this amount to your cash balance. The cash balance shown in the upper right corner of the cash receipts journal screen does not change for each cash receipt that is entered; it changes only after a bank deposit is recorded.

For each receipt, you record the receipt date, the payer (up to 25 characters), a 25-character description (memo field), the amount received, and the appropriate distribution. As with cash disbursements, you can distribute amounts received to up to six financial accounts. Voiding and editing facilities are included here too. If you void a receipt, One-Write Plus automatically recalculates the cash balance and adjusts the bank deposit amount.

Three reports are provided for cash receipts: the Cash Receipts Register, the Distribution Report, and the Bank Deposit Summary. In addition, the Business Pulse

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## ONE-WRITE PLUS

Report is available from either the Cash Disbursements or the Cash Receipts menu. This cash flow analysis report summarizes your current period and year-to-date cash account activity.

### Month-End Accounting Tasks

With One-Write Plus, your monthly tasks are quite straightforward, but you may need some initial guidance from your accountant. As the documentation suggests, you must carry out the following procedures each month to properly post and close your books and print final monthly financial reports:

- Close your Cash Disbursements and Cash Receipts journals.
- Record and print your General journal entries.
- Post journals to the general ledger.
- Record accrual entries for outstanding payables and receivables.
- Print your monthly financial reports.
- Close books for the month (or year).

In closing your receipts and disbursements journals, One-Write Plus summarizes all of your transactions, posts them to your general ledger, and clears the journals so you can start processing next month's transactions. The documentation suggests you make a backup copy of your data disk prior to doing so. Detailed posting registers are automatically printed.

General journals are accounting transactions that do not affect cash but that must be recorded so your reports properly reflect your business's profit/loss performance. Unfortunately, general journal transactions detract from the simplicity of single-entry accounting. Nonetheless, they are necessary to record noncash transactions. For example, you may need to record depreciation expenses each month, such as debiting Depreciation Expense and crediting Accumulated Depreciation. As you might expect with this package, you record these entries on a screen that resembles a general journal (see Figure 5). Each journal entry is limited to ten lines with three (90 character) lines of description. Once you complete all

| GENERAL JOURNAL |                                                                         |                |             |
|-----------------|-------------------------------------------------------------------------|----------------|-------------|
| JE # 1          |                                                                         | DATE: 08/01/84 | SOURCE: GJG |
| LINE            | ACCOUNT / TITLE                                                         | DEBIT          | CREDIT      |
| 01              | 6020 SALARIES AND WAGES                                                 | 4,500.00       |             |
| 02              | 6030 OFFICES' SALARIES                                                  | 3,000.00       |             |
| 03              | 2000 PAYROLL TAXES PAYABLE                                              |                | 3,450.00    |
| 04              | 2000 STATE & FICA TAXES PAYABLE                                         |                | 1,650.00    |
| 05              | 2200 ACCRUED MONIES PAYABLE                                             |                | 2,160.00    |
| 06              | TOTAL:                                                                  | 7,500.00       | 7,500.00    |
| 11              | To recognize annual bonuses payable to officers and employees for 1984. |                |             |
| 12              |                                                                         |                |             |
| 13              |                                                                         |                |             |

Enter the date, press F2 to delete entry, or press F10 to cancel edit

Figure 5: This screen shows how to make general journal entries. Ten lines are available for the various elements of the journal entry, and three lines are available for a description. As the bottom line of the screen explains, you can designate recurring journal entries.

| ACCOUNTS PAYABLE ACCRUAL WORKSHEET |                          |                         |                         |                        |
|------------------------------------|--------------------------|-------------------------|-------------------------|------------------------|
| ACCT NO                            | TITLE                    | AMOUNT OWED LAST PERIOD | AMOUNT OWED THIS PERIOD | INCREASE (or DECREASE) |
| 6200                               | EQUIPMENT RENTAL         | 1,200.00                | 345.00                  | 600.00                 |
| 6220                               | UTILITIES                | 345.00                  | 423.00                  | 70.00                  |
| 6270                               | LEGAL AND ACCOUNTING     | 0.00                    | 1,200.00                | 1,200.00               |
| 6300                               | REPAIRS AND MAINTENANCE  | 0.00                    | 45.00                   | 45.00                  |
| 6320                               | TELEPHONE                | 0.00                    | 607.00                  | 607.00                 |
| 6350                               | TRAVEL AND ENTERTAINMENT | 0.00                    | 225.00                  | 225.00                 |
| TOTALS:                            |                          | 12,545.00               | 3,100.00                | 9,365.00               |

Enter account number or use F2/CMDR and BACKSPACE to scroll forward and back

Figure 6: Here is an example of the accounts payable accrual worksheet screen. If you were making entries for the first month, the column "Amount Owed Last Period" would be blank. The "Amount Owed This Period" column should reflect only your unpaid bills in each of the expense categories.

## ONE-WRITE PLUS

your journal entries for the month, you can print them and post them to the general ledger.

Many of these general journal entries will be repeated each month. Entries such as loan or insurance prepayments may be the same each month and One-Write Plus allows you to set up these entries as recurring journal entries to be automatically

With One-Write Plus, your monthly tasks are quite straightforward, but you may need some initial guidance from your accountant.

rolled forward to the next month. You can, of course, edit them each month as necessary.

If, for tax purposes, you report your business transactions on a cash basis, you may not need to make accrual entries related to your payables and receivables. However, if you are an accrual-basis taxpayer, you need to record how much is owed to you by your customers and how much you owe your vendors. This is necessary because most of the amounts owed to you are considered revenue and increase taxable income. Fortunately, much of what you owe your vendors is considered deductible expenses.

One-Write Plus's unique Record Accrual Entries function consists of two on-screen worksheets that help you calculate the proper accrual entries for accounts payable and for accounts receivable (see Figure 6 for an example of an accrual worksheet for accounts payable). Once you have entered the necessary information, the system automatically generates the proper accrual entries, which helps bring your records from a cash basis to an accrual basis.

(continued)

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\*Bell & Howell, Xerox, MNI Sorbus Service and Princeton Graphic Systems.



## ONE-WRITE PLUS

One-Write Plus generates four major reports: Trial Balance, General Ledger, Balance Sheet, and Income Statement. The general formats for these reports are

fixed, and you'll have to stick with the pre-established account range headings. The simple setup procedures get you up and running quickly. You can add items in

any of the fixed range categories noted above. Only accounts with nonzero balances will appear on the reports. The Income Statement format is informative because it shows current-period and year-to-date figures, as well as each line item as a percentage of sales.

Final closing at period-end is fully automatic, and the program warns you to back up the month-end information. You can choose to close your books each month, each quarter, or once a year.

### Documentation and Support

The documentation for One-Write Plus is excellent and well organized. The casual and nonthreatening manual is arranged in three parallel sections: The first part is intended for your accountant or bookkeeper (if you have one); the second is titled "Learning One-Write Plus" and is, of course, for that purpose; the third section is called "Using One-Write Plus" and serves as an excellent summary reference for the accounting and operational features of the system.

An appendix contains the system-capacity specifications, special hard disk installation information, a predefined chart of account listings, error messages, and a glossary.

Evergreen maintains a toll-free customer support line and also offers an unconditional money-back guarantee within 30 days of purchase. However, the system's logical design and excellent documentation make it very unlikely you'll need either of those services.

Full-featured demo versions of One-Write Plus cost \$25, and the price of the demo can be credited toward the purchase of the entire system.

The core module of One-Write Plus is easy to use and well conceived. An added attraction is its interesting use of standard visual imagery from the accounting world. For professionals and small businesses that still do their books manually, One-Write Plus provides a clear alternative.

—G. William Dauphinais and Michael A. Yesko

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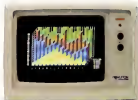
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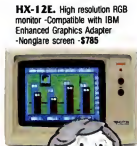
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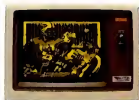
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WORD PROCESSING • M. DAVID STONE

# Wordstar 2000: Laden with Luxury

A host of valuable features make WordStar 2000 a class act, but at a price: They also render it slow and cumbersome.

Illustration: James Sings



## WORDSTAR 2000

Ordinarily, my reaction to the introduction of a new word processor is right up there with how I feel about the newest line of designer jeans—I couldn't care less. But when the word processor is from MicroPro and bears the name *WordStar 2000*, it makes me sit up and take notice.

After all these years, *WordStar* is still the word processor to which all others are compared, and with good reason. Of course, even its most devoted fans can point to a double-handful of limitations in the venerable program, but there's a good reason for that, too: *WordStar* was designed to work with a maximum of 64K of memory.

*WordStar 2000*, in contrast, was designed specifically for the IBM PC with a minimum of 256K RAM. With that much memory to work with, you would expect MicroPro to keep everything that was good about *WordStar* while adding new features to transcend *WordStar*'s limitations.

### Distant Cousins

*WordStar 2000* is not a souped-up version of *WordStar*, and MicroPro is not peddling it as such. Significantly, the company continues to sell *WordStar* at a reduced price, and everyone I spoke to at MicroPro took great pains to point out that the company is actively pursuing further development of *WordStar*—in fact, new



**Figure 1:** With *WordStar 2000*'s triple-window feature, you can open three files at once. (Note: All of the screen shots accompanying this review were taken after *WordStar 2000*'s colors had been reinstalled.)

releases are on the way.

MicroPro calls *WordStar 2000* a state-of-the-art companion program to *WordStar*—a description that may be more confusing than helpful. The two programs are meant for different markets—they bear the same relationship to each other as do a sports car and a luxury car.

Luxury car buyers don't like sports car suspension. Sports car buyers don't like power brakes, power steering, or the living-room-on-wheels design of a luxury car. If *WordStar* is MicroPro's Corvette, then *WordStar 2000* is certainly its Cadillac, and the program must be judged on those terms.

Luxury features in *WordStar 2000* include windows (you can open up to three files at once and move information from one to another; see Figure 1), context-sensitive help (which gives you information based on where you are in the program), a math feature (essentially a four-function calculator), a sort feature (for putting lists in alphabetical order), a key-stroke glossary (otherwise known as a library, for storing boilerplate text or macros), a typewriter mode (for turning your system into an electronic typewriter for

typing envelopes and forms)—the list goes on.

You have to pay a price for these goodies, though. The program is slower than *WordStar*, clumsier to use, and more limited in some ways. It comes on six disks, plus one more if you purchase the *Plus* version. Two of these are tutorials, but you must use the other four (or five) regularly to take advantage of all of *WordStar 2000*'s features.

In underlying structure, *WordStar 2000* bears a family resemblance to its older sibling. The appearance of its opening menu is different from that of *WordStar*, but the concept is similar, giving you a choice of functions: edit, print, spell-check, copy files, and so forth (see Figure 2). Like its predecessor, *WordStar 2000* can reserve the top third of the screen for on-screen menus if you so desire (see Figure 3). Again, these look different than the *WordStar* editing menus, but the concept behind them is the same. The main editing menu is normally on-screen during editing. Type the first letter of a two-letter command, and the editing menu is replaced by a submenu. Type both letters quickly enough, and the submenu will never show up.



### WordStar 2000

MicroPro International Corp.

33 San Pablo Ave.

San Rafael, CA 94903

(415) 499-1200

**List Price:** *WordStar 2000*, \$495 (\$250 as upgrade from *WordStar*); *WordStar 2000 Plus*, \$595 (\$350 as upgrade).

**Requires:** DOS 2.0 or later; 256K RAM for DOS 2.0 or 2.1, 320K RAM for DOS 3.0; two disk drives (hard disk recommended).

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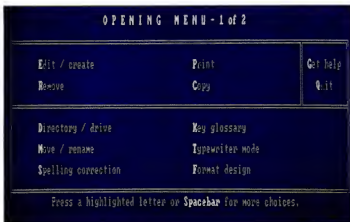


Figure 2: WordStar's opening menu has been revamped to give WordStar 2000 a new look.

As with *WordStar*, you can adjust the program to show all menus, show just the submenus, or show no menus at all. The menu function can be adjusted at any time during editing, and the default setting can easily be changed through a menu choice in the installation program.

#### Mnemonic Menus

*WordStar 2000*'s menus are not only different from *WordStar*'s, they are better. The menu options are more readable

because they are separated by plenty of blank space. More important, *WordStar 2000* is stocked with a new set of commands that is entirely mnemonic. In contrast to *WordStar*'s arcane "T for delete word and "Y for delete line, the mnemonic here is always R for *Remove*: "RW for Remove Word, "RE for Remove Entire line, "RR for Remove Right side of line (from the cursor), and "RL for Remove Left side of line (see Figure 4).

The new command set is not without

problems. Granted, it's much easier to remember "RW for Remove Word instead of "T, but I find it annoying to make more keystrokes for such a frequently used command, especially if I'm deleting several words in a row. Even worse is "RC for Remove Character.

This preference for ease of learning over efficiency of use makes up much of the difference between *WordStar* and *WordStar 2000*. Other differences include *WordStar 2000*'s more-flexible standard features. In the case of the Remove command, for instance, *WordStar 2000* adds the ability to remove by paragraph, sentence, or from the cursor position to any designated character.

Another useful feature is the Undo ("U) command, which lets you restore your last deletion, a handy capability if you've just deleted an entire line when you meant to delete a word. You can also use the Undo command instead of block-move commands to cut and paste text. Just delete the text, move the cursor to where you want to insert it, and hit "U.

*WordStar 2000* makes 46 commands available to you through function keys or their equivalent (cursor control keys and the like). You can redefine more than 30 of these, but MicroPro assumes that most people will use the predefined choices. A plastic template for the PC keyboard is included with the program.

Central to *WordStar 2000*'s luxury status is its practice of storing all formatting information for each file along with that file. This could qualify as either good or bad news, depending on your point of view.

Much of the format information is contained in a format header that the program attaches to the file (see Figure 5). This header includes such details as the number of lines per page, size of the top and bottom margins, number of characters per inch, and the width of each line in inches. You can, of course, define the format for each file, but in my experience, you're generally better off creating a few standard formats and then telling the program

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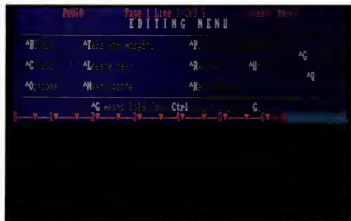


Figure 3: You can choose to display menus on the top third of the screen while editing.

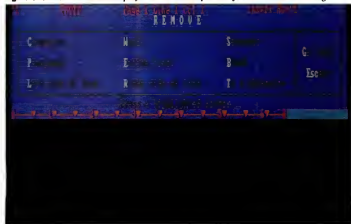


Figure 4: WordStar 2000's command set is expanded from WordStar's and is mnemonic.

which one to use for a given file.

You can modify the format you've chosen at any time. You can also make changes within each file. Embedded ruler lines tell the program where to change margin and tab settings and where to indent or "outdent" paragraphs. Other embedded commands can tell the program to change the number of lines per page or number of characters per inch. Once you've put format information in a file, you can't accidentally lose it—changing

the format is always a deliberate act.

The catch is that dealing with the embedded format information takes time. Whenever you move through a file, *WordStar 2000* reads that file character by character and determines the format as it goes along. Most bothersome to me is that the program can't keep up when you scroll through text—the screen goes blank, and you have to stop scrolling in order to see where you are.

Almost as bad is the extra time this adds

to moving through a file. I timed the program in scrolling from the beginning to end of a ten-page, double-spaced file. On a floppy-based IBM PC, the trip took 16 seconds. Using floppy disks on an AT, it took 10 seconds.

As a point of comparison, I translated the file to *WordStar* and found that the PC took only 7 seconds to go from beginning to end. Even more dramatic differences showed up in block moves and in global search-and-replace operations. Don't take these numbers too seriously, however—they vary dramatically from file to file, apparently depending on how heavily formatted the file is. Nevertheless, I'd have serious doubts about using *WordStar 2000* for files longer than 3,000 words, even on an AT.

### Display's the Thing

The on-screen display in *WordStar 2000* generally follows the "what you see is what you get" concept, with some important exceptions. The program makes no attempt, for example, to show right justification on the screen. It calculates the appropriate place to end each line and shows you the line breaks in ragged-right format.

On monochrome monitors, the program will underline and boldface on screen. Most other print enhancements—including superscript, subscript, and emphasized print—are shown in boldface as well. If you use a lot of different print enhancements and need to distinguish among them, you can display the command tags on screen.

The on-screen underlining has a minor bug in it. One of the questions you have to answer in defining a format is whether you want underlining to include the spaces between words. Your answer will control what shows up on your printer, but spaces between words are underlined on the screen regardless. This glitch doesn't create any real problems, but it is especially ugly when you indent an underlined paragraph. The underlining shows up not only between words, but in the empty space on

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Figure 5: Formatting data is contained in a header that the program attaches to each file.



Figure 6: On color monitors, print enhancements are indicated in different colors.

screen between the left margin and the first word on each line. If you have a color monitor you'll never notice this, however, since underlining and all other print enhancements are indicated with different colored text (see Figure 6).

In addition to these minor departures from the ideal, *WordStar 2000's* on-screen formatting contains a serious bug.

The program includes automatic paragraph reform. Most programs with this feature reformat backwards from the cur-

sor as well as forwards. If you insert text just before the last word at the end of a line (for example, if you insert "to" before "the" to make "tothe"), the whole thing will usually wrap to the next line. Type a space to separate the words, and the first word (in this case, "to") should bounce back to the line above. But *WordStar 2000* reformats from the cursor to the end of the paragraph. This means that once a word wraps to the next line, the word stays, whether it belongs there or not.

When the program prints the file, however, it puts the word on the line to which it should have bounced back, not on the line on which it appears on the screen. A single word showing on the wrong line on the first on-screen page can make a paragraph show on screen as one line longer than it really is, and throw off all the page breaks throughout the file.

MicroPro is aware of this problem and tells me it is high on its fix list. In the meantime, I've found a simple trick that seems to work. Before printing, insert a ruler line at the beginning of the file, using a different line width than you used to create the file. Next, delete the new ruler line. If you then run through the file, the program will reformat as it goes through the file, and you can check the page breaks on the way.

*WordStar 2000* contains a wealth of useful extras in addition to those I've discussed, including a built-in spelling checker and mailmerge capabilities, proportional spacing, multiple-line headers and footers, a very nice facility for moving through subdirectories, and so-called "footnotes" (they're actually endnotes, but the program does automatically renumber them). Accompaniments include a disk-based tutorial (hardly needed) and a set of useful manuals (*MicroPro* learned its lesson on that score. It has also learned about copy protection. *WordStar 2000's* original cumbersome scheme has been removed.)

The *WordStar 2000 Plus* package adds telecommunications, indexing, and what amounts to a baby database program for mailing lists.

In short, *WordStar 2000* is a potentially worthwhile program with serious drawbacks. I wouldn't even consider using it on a floppy-based machine—and not just because of the speed (my impression from using other luxury-class word processors is that slow operation is par for the course). The program uses a lot of disk space and involves entirely too much disk-swapping for my taste. In spite of these reservations, however, *WordStar 2000* is worth a serious look. ■

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# That Special Intuition

This integrated software program from Noumenon may not get the point as fast as its name, Intuit, suggests. But it's a valuable package that includes its own operating system.

**N**oumenon (nu-me-non). A noun derived from the Greek *nooumenon*, from the Greek verb "to conceive." One meaning: an object conceived by reason but not knowable by the senses.

Apparently inspired by its name and the reason and perception it implies, Noumenon Corporation has introduced *Intuit*, an integrated software package for small-business owners and professionals. Its own designer admits *Intuit* lacks bells and whistles, but the package is an economical, practical improvement over the limited single-application software that dominates the PC market. *Intuit* is tough, too; it didn't crash during any of my tests.

*Intuit* includes a text processor, a database program, and a spreadsheet program all rolled up into one simple integrated package. These three programs offer the benefits of consistent command, editing, and file management architecture that allow you, after familiarizing yourself with the text processing section, to move through a database and spreadsheet with ease.

*Intuit* runs on an IBM PC or can manage with 256K of RAM and at least one double-sided diskette drive. The manufac-

turer, however, strongly recommends two floppy drives.

## Its Own System

Although *Intuit* also works with a hard disk, it can run only with disk systems that emulate an IBM XT hard disk, because *Intuit* runs on its own unique operating system—not IBM DOS. According to Martel Firing, *Intuit*'s creator and programmer, the operating system was designed expressly for *Intuit* and meets the needs of the package's software more closely than DOS could, particularly in terms of reducing read/write access speed. Because of this greater efficiency, Firing says, the company does not currently plan to rewrite *Intuit* to run under DOS.

However, you will have to keep your hardware in mind when considering *Intuit*, because many hard disk subsystems require DOS to operate. Since it runs without DOS, *Intuit* will ignore non-XT-emulating hard disks. Firing says Noumenon will be releasing interfaces or device drivers to enable other hard disk products to work with *Intuit* in the future, but none is available now.

Just as the operating system is unique, the programming language may be too.

## INTUITION

But Firing will not divulge the name of the code in which *Intuit* is written.

To run DOS programs and *Intuit* on the same hard disk system, you will have to subdivide your disk, using the DOS 2.0 partitioning routine to separate *Intuit* from DOS system-based programs. Also, you can convert *Intuit* files to DOS files.

### Built Like a Tree

The package comes with a user's guide and a reference guide. *Intuit*'s documentation refers to keys that allow you to format and sort, for example. So you will need to adhere labels onto your function keys and a few editing keys before you begin.

As for working with the program, those familiar with PC- or MS-DOS 2.0 or higher will embrace the program immediately. For others, it's simply a matter of understanding a tree structure.

*Intuit* begins with what it calls the Root directory. The Root directory is where the essence of the program lies, with its application or program utilities and demo. From there you can "branch" off into volumes, subdirectories, or simply a single subject. Remember: *Intuit*'s directories and subdirectories have nothing to do with the DOS features with the same names. "Subjects" are simply files.

Say you have a chinchilla processing company. But you have several chinchilla processing divisions. In the Root directory you would create two directories, one for the domestic chinchilla division and a second for the international division. From

there you would have individual branches for each division, including breeding, processing, marketing, human resources, public relations, facilities, and executive. You can break each of these separate divisions down into individual directories. Why? Well, the human resources division might want to produce a database file on all the company's employees, while the purchasing one may wish to organize a list of its suppliers. Using subdirectories, neither department has to wade through all the other departments' files every time it wants to work with its own information.

Using the logic described above, I was able to create a new directory and separate it from the clutter of the Root directory. This was a matter of moving the cursor down to the last line of the Root directory and typing the name of my new directory. The directory name could be as many as 67 characters, uppercase or lowercase, using as many different words or symbols as could fit into that area.

Because the subjects are all clumped together in one list, *Intuit* needs a method of categorizing them. That is, one subject may be text, whereas another may be spreadsheet. The system needs to have some way of knowing what part of the program the user wishes to work with.

On the far right side of the screen is a column labeled Type. Here I entered the word *directory*. This told *Intuit* I wished to create a directory. With the cursor under this new subject, I depressed SELECT (F1), and a new blank directory appeared on the screen ready for work.

Next, I thought I would try to learn basic elements of *Intuit*: the text processor, database manager, and spreadsheet.

So I entered TEXT in the Type column to indicate I wanted this subject to be a document. And there I was in *Intuit*'s text processor. The processor is of the two-pass, dot command genre, where text is entered between a set of screen margins and later formatted during printing with a combination of dot-imbedded commands and a text formatter. You engage the formatter by depressing the Format key (shift

+ F8), and then the Text Set-Up table appears on the screen. This Set-Up table contains the default format specifications, including page and text length, pitch, spacing, line length, left margin, headers, footers, justification, and automatic page numbering.

There is also an area for defining groups of formats for a document. For instance, I'm writing a proposal and decide that section headings should be centered, subsection headings should be flush left and underscored, and paragraphs within subsections should begin 15 spaces in from the left rather than 10. Thus, by defining the CHAP, SECT, PARA, and SUBP section of the table to correspond to my desired formats and then using the dot commands.CHAP, .SECT, .PARA, and .SUBP to call those formats into the document, I can establish a series of complex formatting commands and change them easily to keep the document consistent throughout with a few dot commands.

You can do block moves and deletions using line mark (LMARK) and character mark (CMARK) commands, with delete line or delete character (labeled DEL L/C on the delete key). I depressed LMARK, and the entire line appeared highlighted. I then marked the end of the block with LMARK again. After moving the cursor to the new position of the text, I depressed MOVE (F5), and there it was. Had I wanted to copy the block rather than move it, I could just as easily have hit COPY (F6). The steps are simple and logical.

The beauty of this technique is that virtually everything in *Intuit* is text. So if you want to copy a subject, you mark that subject in the directory and copy it. You do the same to delete a subject.

Keep in mind, however, that *Intuit* uses a text processor and not a word processor. It's not a "what you see is what you get" program like *WordStar*. Entering text is not all that bad though. *Intuit* does include word wrap for those now used to being able to type line after line without being concerned about carriage returns at the end of each line. You type and edit text, how-



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CIRCLE 795 ON READER SERVICE CARD

## INTUITION

ever, on work space that is later formatted by the formatter and dot commands during printing. This space shows the text and commands within an adjustable right margin on the screen. But what appears on the screen is not what finally appears on the paper. If you want to see the formatting results before printing, *Intuit* allows you to print the subject to the screen showing margins and page breaks.

Noticeably missing from the print options were selected pages, but *Intuit* has accommodated that. By marking sections using the LMARK (F3) or CMARK (F4), you will print only text that has been marked. Single-sheet printing and continuous feed are other options.

Once done with my proposal, I was ready to move on. To return to my directory, I depressed PREV (F2), for previous, and I was back to my newly created directory. Probably somebody out there is now asking, where's the text? Besides moving you backward through the program, PREV also saves the document, database, or spreadsheet you have just completed. It also stores format changes, meaning that when you return to the subject, all the modifications made in the last session are faithfully intact. This function is one of the strongest in the *InnuIt* software package. It frees the user from the tedium of manually saving and updating to diskette.

So how about an electronic Rolodex file to keep track of my editors? Once again, I entered a subject name from my directory, but this time I entered RECORD in the Type column. Now I was into the database manager.

For some reason the program defaults to two fields. To set up my own structure, namely the information I wished to include in each record or on one of my file cards, I once again depressed **FORMAT**.

A database Format screen was now displayed with line or field numbers running down the left side. By typing in the field name (an information label) on each line of my file card and then placing the number of spaces I would need for each field within brackets, I structured my database

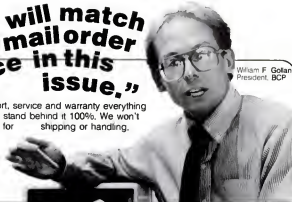
quickly. Hitting PREV faithfully returned me to the database manager screen to see the field names as column headings to my newly formatted database subject. Mod-

ifying a field name or length required only that I return to the Format section of the database and modify as needed. One interesting point was that although fields could

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CIRCLE 270 ON READER SERVICE CARD





## INTUITION

the user's standpoint, if a column of figures is to be totaled and the result placed in a certain cell, a well-structured set of instructions is placed in the cell that will

contain this total. *Intuit's* tables, however, are computed from without. That is, numeric information is acted on by a series of procedures, in essence, miniprograms.

Thus, instead of simply updating the sheet automatically after information is modified, these procedures are run again so that the table reflects the new information.

From a programmer's standpoint, this feature allows flexible and powerful calculation capability on data. But, then, how many of us are programmers?

The language is complex and arduous. The program "sentence," as *Intuit* describes it, is vague and difficult to follow and use. And, creating a table is anything but fast. Granted, it was my first time at *Intuit's* helm, but to do my first table, a simple columnar subtotalling and totalling, took me about 4 hours.

This free-form flexibility stops short at printing. Formatting, as with the Forms, Reports, and Text, was missing for the tables. There seemed no way to position the table on a sheet of paper with top margin, right margin, or text length formats. The way it appeared on the screen was the way it would print.

The few odds-and-ends of the package are that the Root directory houses the installation, and the diskette and hard disk formatting utilities. As a carryover from the hard disk, diskettes are referred to as "volumes." *Intuit* will support up to nine disk drives and, though unrealistic, 127 hard disks. Like any other subject, new volumes are recorded on the Root directory but typed as a volume.

*Intuit* data diskettes have to be initialized with their own format. Also you need a clear understanding of the Root directories and *Intuit* volumes. In a two-floppy-drive PC system, drive A: runs the Root directory, and B: contains a volume. In theory, on a two-disk-drive system, for every volume or data diskette, you need the unique Root directory that refers to that volume. I suppose you could fool the system by manually switching the volume diskettes at key points, but this defeats the point of a user-transparent file management system. Because of this, I would strongly recommend that a prospective buyer of *Intuit* have a hard disk. But again,

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## INTUITION

it must be a PC-XT or XT-emulating hard disk to work with *Intuit*.

And depressing PREV doesn't guarantee that all your work has been saved to

diskette. First, some of the file saving *Intuit* says that it's doing is saved in memory. It is therefore important that you leave the program using EXIT (F2) to insure that

your data is accurately saved.

If you install your printer properly, *Intuit* supports underlining, bold, super-, and subscripting, as well as user-definable codes for implementing, say, condensed type on a dot matrix printer. *Intuit* comes installed for an Epson 100 and a DCT 302—that's it. To install my NEC 3500, I had to get codes from an old printer manual and tell them to *Intuit*. The codes were sent to my printer for achieving special print functions.

If you need to punch up a few numbers, *Intuit* supplies you with a four-function calculator (Shift + F7). The documentation also refers to a clock, but the clock must emulate an IBM real-time clock.

The user's guide is a scaled-down version of the reference guide, which is illuminated by a series of appendixes. On-screen help is available at the touch of EXPLAIN (F8).

With the exceptions I have mentioned, *Intuit*'s program flow is good. With a basic understanding of, for instance, editing, keystrokes and theories are identical from one section to another. Data integration is most effective between the database manager and text processor. There was no real integration between the tables and the other *Intuit* subject types.

As for Noumenon itself, the company has a novel marketing concept. In August 1984, Noumenon began selling *Intuit* for \$50 but planned to increase the price weekly by \$20 to let the market establish the price. I'm not sure what the price will be by the time this article is published, but the innovation in Noumenon's marketing should be applauded.

Finally, there may be something to be said for bells and whistles, but *Intuit* is worth looking at, especially if you don't have money to kill and you need integration. I can't stress enough the importance of the hard disk storage, but to kill the pain, I will inject a few incentives from the company. Look forward to telecommunications, extended database management capability, writer's tool kit, and graphics all as add-on options in the future. ■

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The Electronic University (EU) is the latest brainchild of Ron Gordon, a 44-year-old high-tech entrepreneur described by *Business Week* as "one of Silicon Valley's wizards." Gordon was president of Atari before it was acquired by Warner Communications. After a brief retirement, he founded Friends Amis Inc., which developed a pocket language translator and a hand-held computer and was then bought out by Matsushita Electric.



## ELECTRONIC UNIVERSITY

Now he's promoting the Electronic University through his new company, TeleLearning Systems of San Francisco.

### A Winning Combination

EU combines hardware, software, and a communications network to create an on-line correspondence school. The software turns your PC into an electronic tutor that calls you by name, asks questions to test your understanding, and gently corrects your errors. It also allows you to communicate with the instructor, who monitors your progress and answers your questions.

TeleLearning began marketing the Electronic University in late 1983, and by the end of November 1984, some 1,500 students had enrolled. The initial offerings were mainly personal improvement and hobby courses, such as "Wines Around the World," "Container Gardening for the City Dweller," and "Crap-Shooting for the Innocent." Gordon explains that these noncredit, recreational courses were designed to attract students. "It's difficult to market a new razor without any razor blades," he comments.

However, now that the Electronic University is up and running, TeleLearning is concentrating on college-level courses. It

is working together with some 2,000 participating schools that will grant college credit to students who complete an Electronic University course and pass a proctored final exam.

### CLEPomania

One way to get academic credit is to use a TeleLearning course as preparation for a college credit exam and then transfer credits to a school that will accept them toward a degree. Many colleges and universities award course credit to students who pass a proctored exam or earn satisfactory scores on college-level tests given by independent testing services. Two widely recognized independent testing programs are the College Level Examination Program (CLEP) and the American College Testing Proficiency Examination Program (ACT PEP).

Some 1,800 institutions accept CLEP and ACT PEP scores in place of their own courses toward the fulfillment of degree requirements. EU courses aimed at meeting CLEP and ACT PEP requirements include English composition, literary analysis, psychology, American history, college algebra, biology, economics, American government, finance, management, marketing, and accounting.

Another way to earn credits is by taking computerized courses at a school that develops the coursework but uses Electronic University equipment and network time. A number of educational institutions offer their own courses through EU. For these schools, EU simply acts as a conduit in transmitting course material to students. Electronic University provides the hardware, controlling software, and a communications service, while the school supplies the instructors and courses.

A third option is to enroll at an external degree college such as Edison College in Trenton, New Jersey. Edison's educational philosophy is that people deserve credit for what they know, no matter how they came to know it. A number of Electronic University courses can be used as preparation for Edison College exams, and Edi-

son has even prepared sample curriculum sequences to show how Electronic University courses could be combined to earn a degree.

TeleLearning also allows professional organizations to use the Electronic University to bring continuing education courses to their members. This service offers electronic mail and access to some 60 on-line databases.

### A Wealth of Libraries

The same communications network that processes your coursework and allows message exchange with your instructor also gives you access to TeleLearning's Electronic Library. This library consists of a set of more than 60 on-line databases from Bibliographic Retrieval Service (BRS) of Latham, New York, one of the country's largest vendors of on-line information. The Electronic Library includes such databases as the United Press International Wire Service, the Medlars medical database, and the Academic American Encyclopedia. If you plan to do at least \$15 worth of on-line searching per month (the library's minimum usage fee), it can be less expensive to use the Electronic Library than to use BRS directly. The lower fees are possible because TeleLearning has contracted for a large amount of on-line time and passes the resulting volume discounts on to its students. Depending on the database you need and the time of day, using the Electronic Library can cost as much as 80 cents per minute or as little as 17 cents.

### Celebrity Circuit

Similar to a real college, the Electronic University invites renowned experts to give short, not-for-credit lectures and seminars. Recent electronic lecturers have included legal superstar Melvin Belli, Harvard professor and author Daniel Bell, and sports medicine specialist James Skinner. For a registration fee, ranging from \$12 to \$20, plus communications charges of 17.5 cents per minute, you can view these on-line lectures, comment on the material,



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## ELECTRONIC UNIVERSITY

and see comments of other participants. If you miss the real-time, on-line session, you can view a recorded version and send comments and questions to the lecturer via TeleLearning's electronic mail. The lecturer answers you through your electronic mailbox. Depending on the seminar, the period during which you can contact the expert lasts from 3 to 14 days.

### Easy Enrollment

Electronic University enrollment involves minimal preliminaries. You enroll by purchasing an enrollment kit from one of more than 800 retail outlets throughout the country or directly from TeleLearning. If you already own a Hayes Smartmodem, you can buy the \$89 enrollment kit, which contains the Electronic University software, a user's guide, and a course catalog. For an additional \$110, you can get the enrollment kit with TeleLearning's 300-baud autodial modem.

Once you hook up your modem and copy some operating-system programs to your Electronic University disk, you contact TeleLearning and enroll formally. The program takes you through a simple sign-up procedure: you type in your name, address, and hardware information. This information, stored in TeleLearning's mainframe computer in Maryland, gives you a lifetime enrollment in the Electronic University.

Now, you're ready to take a course. You can independently select your course from the catalog that comes with your enrollment kit or confer with a TeleLearning counselor. To register, you call TeleLearning's toll-free number and charge the course on a major credit card. Or, you can type your order using the Electronic University software and then send it to the registrar via TeleLearning's electronic mail. You'll be billed for it later. In a few days, your course disk and text books will arrive in the mail.

### Taking It Personally

To get a closer look at the Electronic University, I registered in three Tele-

Learning courses: Reading Aloud to Your Child (\$45), Time Management (\$80), and College Composition (\$115). The first two are recreational courses with light reading assignments; the third is a serious, college-level course that attempts to prepare students for the CLEP test in English composition. I came away both impressed by the Electronic University's potential and disappointed by some of its limitations.

On the positive side, the system is easy to learn, even if you don't know much about using a computer. When you first purchase an Electronic University enrollment kit, you have to perform a simple setup procedure to copy some operating-system programs from your DOS disk to the Electronic University disk. The detailed menus carefully guide you through all of the Electronic University's functions. And when you're finished with your lesson, one of the menu items asks if you want to return to the operating system. If you confirm that you do, it returns you to DOS.

Since TeleLearning's software automatically handles all communications, you don't have to set baud rate, parity bits, or any other parameters. You don't even have to worry about passwords or network sign-on sequences. You just tell the software to send a message, and it does the rest. If you encounter any unforeseen problems, you can contact the TeleLearning counselors via a toll-free customer service line.

### Close Interactions

Two strong aspects of the Electronic University format are its creative use of the computer as a tutor and the amount of teacher-student interaction that the system allows. Interaction with your instructor is often the best part of an EU course. When a course begins, you write a short essay that introduces yourself and describes what you hope to get out of the course. Using that information, the instructor is then able to tailor the course to your particular needs.

In some ways the teacher-student interaction can be more personal via computer than it is likely to be in a conventional classroom. Miriam Ylvisaker, who teaches the Electronic University's College Composition class, believes her TeleLearning students express themselves more freely than her classroom students do. The compositions often resemble personal letters to a friend. "Perhaps because neither side sees the other, it allows for more freedom," she suggests.

The Electronic University creatively uses the computer as a tutor to handle introductory material. Each lesson begins with a "lecture notes" section that emphasizes key concepts from your reading assignments. In some cases, the computer asks you questions and responds to your answers. For example, my first time management lesson included a questionnaire to determine how well I manage my time. After I answered the questions, the software added up my score and ruled that I am "easygoing, even lackadaisical, and often successful in accomplishing what has to be done. . . . Time neither enslaves nor masters you." Not a bad description, if I do say so myself.

In addition to the lecture notes, many EU lessons include an "electronic workbook" that asks you questions about the course material and comments on your answers. Most lessons conclude with a progress evaluation or quiz to test your understanding. When you're satisfied with your answers, you send them to the instructor via TeleLearning's electronic mail, and the software unlocks the next lesson on your disk. In a day or two, you can check your electronic mailbox and read your instructor's responses. Or, if you prefer, you can arrange a modem-to-modem chat, where you type your questions and see your instructor's responses on your screen.

To keep the lessons lively, the Electronic University uses striking graphics, such as the computerized photo of the instructor that appears in the introduction for each course. In many of the courses,



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## ELECTRONIC UNIVERSITY

pictures, charts, and other graphics illustrate the on-screen text. Graphics are an important part of the "knowledge templates," which are carefully designed and formatted exercises based on proven teaching techniques.

### The Bad News Bugs

Despite the technical excellence of much of this service, I found a few bugs. Technical difficulties kept my Reading Aloud instructor, Amy Spaulding, from responding to my questions for 4 days. Later, when we arranged a real-time chat, TeleLearning's mainframe computer was down, which prevented our conversation. We rescheduled the chat and were finally able to converse via computer, but that too held its disappointments. The TeleLearning software did a fine job of keeping track of whose turn it was to talk by flashing

"Instructor" when it was Spaulding's turn and "Student" when it was my turn, but I found the process almost unbearably slow.

Ron Gordon explained that TeleLearning keeps your communications costs down by sending data in bursts. In between bursts, your equipment doesn't tie up the line. This process allows for economical cross-country conversations (a 20-minute chat costs less than \$1), but it also causes 30- to 60-second delays as you wait for the next burst to appear on your screen.

The Electronic University's built-in text editor, which you use for answering essay questions, is also disappointing. It's a no-frills, full-screen editor that includes only the basic text-editing functions: inserting and deleting text, cursor movement, and scrolling. The system automat-

ically saves and retrieves files. However, you can't compose an essay using a word processing program and then transfer your essay to the Electronic University editor because EU's restrictions on its telecommunications process preclude the use of special characters; thus its files are closed to material created on a conventional word processor. Material that you are working on can be revised, but once a lesson is completed and corrected, space requirements make it necessary to delete the finished material.

Ron Gordon says his programmers are working on a way to allow students to review their essays and completed quizzes. As these and other improvements are made, they will become available to Electronic University students immediately because TeleLearning sends out an updated system disk with each new course.

Despite these difficulties, I was impressed with the overall quality of the Electronic University, and I was especially pleased by Miriam Ylvisaker's composition course, which was every bit as challenging as my own freshman English class. It even had some pointers that I found useful.

### Fast and Flexible

Computerized courses offer several advantages over traditional correspondence courses. The first is speed: When you submit assignments by computer, you hear from your instructors within 2 or 3 days rather than the 2-week (or longer) turnaround for courses taught by mail. Second, the excitement of using computers helps maintain student interest. Traditionally, correspondence-course students have a high dropout rate because it's difficult to maintain involvement and motivation when studying alone. But, the greatest advantage is convenience; you learn at your own speed in your own home, without having to squeeze class meetings into a crowded schedule. For many, that flexibility makes the Electronic University a real bargain.

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CIRCLE 152 ON READER SERVICE CARD

# THE SIMPLE APPROACH IS THE SYMBOL APPROACH.

```
10 S=0
20 FOR I=1 TO 100
30 INPUT X
40 IF X = 0 GOTO 70
50 S=S+X
60 NEXT I
70 PRINT S/(I-1)
```

## BASIC

*A program to calculate averages...*

```
REAL X(100)
READ*,N,(X(I),I=1,N)
S=0
DO 10 I=1,N
10 S=S+X(I)
PRINT *,S/N
END
```

## FORTRAN

*just shrunk from seven lines...*

$(+ / X) + \rho X + \square$

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*to one.*

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# Printing Program Files

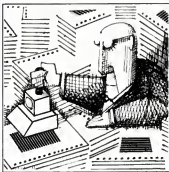
If your program printouts never have that "just right" look, PR.COM is just the right utility to add to your collection.

**C**an't anyone do it right?" moaned a friend and fellow PC programmer. The latest version of his favorite utility package had just arrived, but its PRINT command still wouldn't print out his C, BASIC, and Assembler programs properly. "It doesn't even expand the ASCII tabs or print the file's save date and time," he lamented. "What's a programmer to do?"

Actually, there aren't many alternatives for printing program files with the PC. Most word processors have print routines that work adequately for their own files, but these contain unique, program-specific format codes. Word processors generally don't do a good job of printing the straight ASCII files that occupy the bulk of a programmer's disk space. You could, of course, insert those format codes, but if you do, you'll find that they will not be understood, or even tolerated, by compilers, interpreters, and assemblers.

While most program editors will print ASCII files, they don't usually print the file name or its save date and time, or do any kind of page formatting. The results are often illegible or unusable—especially if the program file contains lines longer than 80 characters. Further, listings made with program editors always seem to follow the "jelly-side-down" rule by printing exactly on the page perforations of continuous form paper.

## 1985/No. 8



PC-DOS gives only minimum support to printing standard ASCII files. True, the PRINT command available in PC-DOS Versions 2.0 and up is a big improvement over the COPY command you had to use for printing under previous versions of PC-DOS. It knows how to expand the tab characters used by most editors to compress ASCII files, for example. However, PRINT.COM brings with it serious performance problems associated with its spooler design, and it has the same other failings as the print routines in program editors.

Since I hate to see a grown man cry, I decided to write a small assembler program that would give my friend the ASCII file printing features he wanted. The ver-

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## PROGRAMMING

sion of PR.COM (PR for short) presented here in Figure 1 has fewer formatting features than it might have but should take care of 99 percent of his needs, and probably yours, as well.

PR.COM formats text into the 80-character lines (after ASCII tabs have been expanded) that most programmers prefer.

Listings made with program editors always seem to follow the "jelly-side-down" rule by printing exactly on the page perforations.

It prints a header at the top of each page that contains the file's name (including disk drive and path, if specified), the save date and time, and the page number of the listing. The page header data is formatted within a graphic box that any ASCII printer will print correctly: no special, IBM-only characters are used.

The page header also serves a second purpose. It leaves enough space at the top of each page so that even if your printer starts out perilously close to the page perforations of continuous form paper, PR will print neat pages and not print on the perforations. PR also leaves a space at the bottom of each page, after printing its 7-line page header and 55 lines of text. (A standard page has 66 lines.) If you wish, you can force PR to feed in a new page and print a page header by embedding a form feed code (ASCII 12) anywhere in the text—usually in a comment line.

A sample of a typical PR printout is shown in Figure 2. The assembler fragment there is actually the BIN\_2\_ASC subroutine from PR.ASM itself. The page header was forced by embedding a form feed in a comment just before the PROC

statement; another, just after the ENDP statement, forced the page to end at less than the normal 55 program lines.

PR's syntax is what a PC user would expect:

```
PR [d:][path]filename[.ext]
```

This makes it operate just like the PC-DOS PRINT command. You can use wildcard characters in the filename and extension, and PR.COM will print all files meeting the wildcard specification.

As written, PR.COM uses PC-DOS function calls (via interrupt 21H) that only work with Versions 2.0 or later. The program doesn't make a version check, but you can easily make it do so, or you could reconstruct it to use function calls that work in earlier versions of PC-DOS.

PR.COM was designed as a series of subroutines because several of them had to be called from more than one place. If you want, you can eliminate the noncritical ones at first, then add them later. If you take this route, PR.ASM itself makes a dandy test file.

As usual, it helps if you have copies of IBM's *Macro Assembler* and *DOS Technical Reference* manuals handy so you can see what each instruction and PC-DOS call is doing. The comments in the PR.ASM listing will help you understand what's going on (don't forget to include them in your own version), but it always pays to read the official documentation. PR is designed to become a .COM program, so after assembling (MASM or ASM, Release 1 or 2, will do fine) and LINKING it, don't forget to use EXE2BIN to convert it, and to rename the .BIN file output to .COM.

### Examining the Code

PR begins by parsing the parameters passed to it by PC-DOS in the Program Segment Prefix (PSP). In this case, all that is required is the one filename. Even if this includes a drive specification, path, and wildcards, it's still only one character string. If no parameters are found, PR exits with an error message. PR changes

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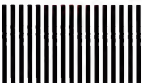
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## PROGRAMMING

```

;
;
CSEG segment para public 'CODE'
 assume cs:cseg,ds:cseg,ss:cseg,es:cseg
 org 100h ; .COM file format
BEGIN: jmp PR_MAIN ; Skip around data declarations
 COPYRIGHT db 'Print (C) 1985, Dickinson Associates Inc.'
 db 13,10,'$'
 VALID_IN db '/abcdefghijklmnopqrstuvwxyz,;=,9'
 VALID_OUT db '\ABCDEFGHIJKLMNPOQRSTUVWXYZ',4 dup(32)
 VALID_NUM equ $ - VALID_OUT + 1
 FN_AREA db 77 dup (0)
 FN_LOC dw offset FN_AREA ; Initialize at FN_AREA
 PRN equ 4 ; PC-DOS printer device handle
 MAX_LINES equ 55
 MAX_CHARS equ 80
 FILE_HANDLE dw 0
 READ_LENGTH equ 256
 READ_BUFFER db READ_LENGTH dup (0),0
 READ_PTR dw offset READ_BUFFER
 PRINT_LENGTH equ 256
 PRINT_BUFFER db PRINT_LENGTH dup (0)
 PRINT_PTR dw offset PRINT_BUFFER
 EOF_FOUND db 0
 CHAR_COUNT dw 0
 LINE_COUNT db 0
 PAGE_COUNT db 0
 BIN_ASC db 10
 HEAD_1 db 13,10,13,10,'*',78 dup ('-'), '*',13,10
 HEAD_2A db '| File: '
 HEAD_2B db 70 dup (' '), '|',13,10
 HEAD_3A db '| Saved: '
 HEAD_3B db '00-00-00 at '
 HEAD_3C db '00:00:00 '
 HEAD_3D db '0m',39 dup (' '), 'Page '
 HEAD_3E db '00 |',13,10
 HEAD_4 db '*',78 dup ('-'), '*',13,10,13,10
 HEAD_LGTH dw $ - HEAD_1
 ERR_HEAD db 10,13,'Print Error - $'
 NO_FILE db 'Correct Syntax is:',13,10,10
 db 'PR [d:][path]filename[.ext]$',
 FILE_NOT_FOUND db 'File Not Found$',
 OPEN_FAILURE db 'File Open Failure$',
 READ_FAILURE db 'File Read Failure$',
 ERR_TAIL db 10,10,13,'. . . Aborting',10,13,13,'$'

;
PR_MAIN proc near ; PR's main program
 lea dx,COPYRIGHT ; Display copyright notice
 mov ah,9h ; Request display string
 int 21h ; Call PC-DOS
 mov si,80h ; Point SI to beginning of PSP parm area
 lea di,FN_AREA ; Point SI to internal file name area
 mov cx,byte ptr [si] ; Get byte count to AL
 xor ch,ch ; Zero CH
 jcxz NONE ; If CX is zero, no parameters passed

```

(Figure 1 continues)

Figure 1: The assembly language listing for PR.COM.

# PROGRAMMING

```

 cld ; Set direction flag to forward
 inc si ; Adjust SI to beginning of parms
 mov dx,0 ; Use DX for leading blanks flag
CLEAN: lodsb ; Load each character to AL
 push di ; Save DI on stack
 mov di,offset VALID_IN ; Point to table of valid inputs
 push cx ; Save CX on stack
 mov cx,VALID_NUM ; Set CX to number of inputs to look for
repne scasb ; See if any are in AL
 jcxz CLEAND ; If not, change nothing
 mov bx,VALID_NUM ; Set up BX to point to valid output
 sub bx,cx ; This will leave BX one off
 mov al,VALID_OUT [bx - 1] ; Load the valid output (adj BX) to AL
CLEAND: pop cx ; Restore CX
 pop di ; Restore DI
 cmp dx,1 ; If leading blanks have been stripped,
 je CLEANC ; go check for colons & other things
 cmp al,' ' ; Is AL a leading blank?
 je CLEANX ; Yes, ignore it & don't store it
CLEANC: mov dx,1 ; If here, leading blanks are stripped
 cmp al,':' ; Is AL a colon?
 je DELIM ; Yes, it's a potential FN delimiter
 cmp al,'\' ; Is AL a backslash?
 jne DELIMX ; Yes, it's a potential FN delimiter
DELIM: mov FN_LOC,di ; Set FN_LOC at current DI + 1
 inc FN_LOC ; -- last one set will be correct
DELIMX: stosb ; Store modified AL back to PSP
CLEANX: loop CLEAN ; Loop until CX is zero
 jmp NONE ; Go see if file exists
NONE: lea dx,NO_FILE ; Exit with error if no parameter
 jmp EREXIT ; passed
FINDF: mov ah,4eh ; Request find 1st file
 mov cx,0 ; Set CX for normal files
 lea dx,FN_AREA ; Point DX to internal file name area
 int 21h ; Call PC-DOS
 jnc FOUNDF ; Ok, found the 1st file
 lea dx,FILE_NOT_FOUND ; If 1st file not found, exit
 jmp EREXIT ; with error
FOUNDF: mov EOF_FOUNDF,0 ; Initialize end of file flag
 mov PAGE_COUNT,0 ; Initialize page counter
 mov FILE_HANDLE,0 ; Initialize file handle
 mov di,FN_LOC ; DI points to end of path
 mov si,9eh ; SI points to file name in default DTA
 mov cx,13 ; DTA file name has 13 bytes
rep movsbl ; Move bytes to FN_LOC (in FN_AREA)
 mov ah,3dh ; Request open file pointed to by DX
 mov al,0 ; Read permission requested
 lea dx,FN_AREA ; Internal File Name Area
 int 21h ; Call PC-DOS
 mov FILE_HANDLE,ax ; Save File Handle contained in AX
 jnc DO_PR ; No carry means successfully opened
 lea dx,OPEN_FAILURE ; Open file failed, exit
 jmp EREXIT ; with error message
DO_PR: call STAMP ; Set file name, date & time stamps
 call PAGE_HEAD ; Print page header
 mov di,PRINT_PTR ; Initialize DI to PRINT_BUFFER

```

(Figure 1 continues)

# PROGRAMMING

```

PRLOOP: call READ_FILE ; Read data to buffer
 jc EREXIT ; Exit if error
 jcxz FINISH ; If CX is zero, end of file was reached
 call PRINT ; Format and print buffered data
 cmp EOF_FOUND,0 ; Was end of file flag set?
 je PRLOOP ; No, keep going
FINISH: call NEW_PAGE ; Yes, print page feed
 call CLOSE_FILE ; Close file
 mov ah,4fh ; Request find next file
 mov cx,0 ; Set CX for normal files
 int 21h ; Call PC-DOS
 jnc FOUND ; If no carry then found the next file
EXIT: ret ; If carry, exit to PC-DOS
EREXIT: push dx ; Save error message pointer on stack
 mov dx,offset ERR_HEAD ; Display error header
 mov ah,9 ; Request display string
 int 21h ; Call PC-DOS
 pop dx ; Restore error message pointer
 mov ah,9 ; Request display string
 int 21h ; Call PC-DOS
 mov dx,offset ERR_TAIL ; Display error tail
 mov ah,9 ; Request display string
 int 21h ; Call PC-DOS
 call CLOSE_FILE ; Close any open file
 jmp EXIT ; Go exit to PC-DOS (all errors fatal)

PR_MAIN
;
READ_FILE proc near ; Load CX bytes to read buffer
 mov bx,FILE_HANDLE ; Set BX to current File Handle
 mov dx,READ_PTR ; Point DX to read buffer
 mov cx,READ_LENGTH ; Set CX to read buffer length
 mov ah,3fh ; Request read file
 int 21h ; Call PC-DOS
 jnc RD_OK ; No carry, then read was Ok
 lea dx,READ_FAILURE ; Can't imagine what error occurred
 jmp EX_RD ; unless coding error in file handle
RD_OK: cmp cx,ax ; If CX chars were read (noted in AX)
 je NO_EOF ; then not at end of file (CF clears)
 mov EOF_FOUND,1 ; Otherwise, end of file reached
 mov cx,ax ; Refresh CX in case end of file reached
NO_EOF: mov EX_RD: ret ; Return to caller
 read_file endp

;
PRINT proc near ; Format and print output buffer
 mov si,READ_PTR ; Set SI to read buffer
 FORMAT: cmp LINE_COUNT,MAX_LINES ; Is page full?
 jb LOAD ; No, go get next character
 call NEW_PAGE ; Yes, print end of page / new page
 call PAGE_HEAD ; Print page header
 LODSB ; Get character to AL
 cmp al,26 ; Check for EOF character
 je AGAIN ; Ignore it
 cmp al,9 ; Is AL a Tab?
 jne PUT_IT ; No, put char in print buffer
 mov al,32 ; Load AL with blank to expand Tab

```

(Figure 1 continues)

# PROGRAMMING

```

TAB_X: stosb ; Move AL to print buffer
 inc CHAR_COUNT ; Increment line character counter
 test CHAR_COUNT,7 ; Is Tab expanded? (this does mod 8)
 jnz TAB_X ; No, keep loading blanks
 jmp WDTH ; Go check current line width

PUT_IT: stosb ; Move AL to print buffer
 inc CHAR_COUNT ; Increment line character counter
 cmp al,13 ; Is AL a CR?
 je AGAIN ; Yes, go force next character
 cmp al,10 ; Is AL a LF?
 jne FF ; No, check for Form Feed
 call PRINT_LINE ; Yes, print current output buffer
 jmp AGAIN ; Go get next character
FF: cmp al,12 ; Is AL a Form Feed?
 jne WDTH ; No, check current width
 call NEW_PAGE ; Yes, print end of page / new page
 call PAGE_HEAD ; Print page header
 jmp AGAIN ; Re-start loop
WDTH: cmp CHAR_COUNT,MAX_CHARS ; Is buffer full?
 jb AGAIN ; No, go get next character
 cmp byte ptr [si],13 ; Yes, see if CR is next character
 je AGAIN ; Yes, then go get it and continue
 mov ah,10 ; No, force CR,LF sequence
 mov al,13 ; into print buffer
 stosw ; Move AX to print buffer
 add CHAR_COUNT,2 ; Add two bytes to character counter
 call PRINT_LINE ; Print the line
AGAIN: loop FORMAT ; Loop bottom
PRINT endp ; Return to caller

; PRINT_LINE
 proc near ; Print a full or complete line
 push ax ; Save affected registers
 push cx ; currently in use
 mov dx,PRINT_PTR ; Set DX to point to buffer
 mov cx,CHAR_COUNT ; Print CHAR_COUNT characters
 mov bx,PRN ; PC-DOS printer device
 mov ah,40h ; Request write to device
 int 21h ; Call PC-DOS - error unlikely here
 mov di,PRINT_PTR ; Refresh DI
 mov CHAR_COUNT,0 ; Refresh CHAR_COUNT
 inc LINE_COUNT ; Increment line counter
 pop cx ; Restore registers
 pop ax
 ret
 PRINT_LINE endp ; Return to caller

; NEW_PAGE
 proc near ; Print end of page / new page
 cmp al,12 ; Does AL have a form feed?
 je FF_OK ; Yes, so it's in the buffer
 mov al,12 ; No, put one in the buffer
 stosb ; Store AL in the buffer
 inc CHAR_COUNT ; Increment character counter
FF_OK: call PRINT_LINE ; Print current buffer
 mov LINE_COUNT,0 ; Refresh line counter
 ret ; Return to caller

```

(Figure 1 continues)

# PROGRAMMING

```

NEW_PAGE endp
;
PAGE_HEAD proc near ; Format and print page header
 push di ; Save DI on stack
 inc PAGE_COUNT ; Increase page counter
 mov al,PAGE_COUNT ; Set up to convert page
 lea di,HEAD_3E ; counter to ASCII
 call BIN_2_ASC ; Convert to ASCII
 pop di ; Restore DI
 cmp HEAD_3E[0], '0' ; Does page counter have leading 0?
 jne NOT_0 ; No, don't do anything to it
 mov HEAD_3E[0], ' ' ; Yes, make it a blank
NOT_0: push cx ; Save CX on stack
 mov ah,40h ; Request write to device
 mov bx,PRN ; Request PC-DOS printer device
 lea dx,HEAD_1 ; Point to page header
 mov cx,HEAD_LGTH ; Write all bytes in page header
 int 21h ; Call PC-DOS
 pop cx ; Restore CX
 ret ; Return to caller
PAGE_HEAD endp
;
STAMP proc near ; Move file name, date & time stamps to page header
 lea si,FN_AREA ; Internal file name
 lea di,HEAD_2B ; Location of file name in page header
 mov cx,70 ; Load up to 70 chars in file name field
LD_FN1: lodsb ; Get character to AL
 cmp al,0 ; Is it the terminating zero?
 je LD_FN2 ; Yes, go fill remainder with blanks
 stosb ; No, store to page header field
 loop LD_FN1 ; Loop until 0 found or CX zero
 jcxz DATE ; If out of room in page header, quit
LD_FN2: mov al,32 ; Load rest of field with blanks
rep stosb
DATE: mov si,98h ; Date position in default DTA
 lea di,HEAD_3B ; Month position in page header
 lodsw ; Packed word field
 mov bx,ax ; Make a copy in BX
 and ax,01e0h ; Isolate month field
 mov cl,5 ; Align to AL register
 shr ax,cl ; by shifting right 5 bits
 call BIN_2_ASC ; Convert binary month to ASCII
 mov ax,bx ; Restore AX from BX
 and ax,1fh ; Isolate day field
 inc di ; Day position in page header
 call BIN_2_ASC ; Convert binary day to ASCII
 mov ax,bx ; Restore AX from BX
 and ax,0fe00h ; Isolate year field
 shr ah,1 ; Shift right to align
 add ah,80 ; AH is years since 1980
 mov al,ah ; Move to AL for division
 inc di ; Year position in page header
 call BIN_2_ASC ; Convert binary year to ASCII
TIME: mov si,96h ; Time position in default DTA
 lea di,HEAD_3C ; Hours position in page header
 lodsw ; Packed word field

```

(Figure 1 continues)

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## PROGRAMMING

```

mov bx,ax ; Make a copy in BX
and ax,0f800h ; Isolate hours field
mov cl,11 ; Align to AL register
shr ax,cl ; by shifting right 11 bits
mov HEAD_3D[0], 'a' ; Assume it's an 'am' time
cmp al,12 ; Check for noon
jb AM_OK ; If less, it's AM
je PM_OK ; If equal, it's 12 PM
sub al,12 ; If more, it's after 12 PM

PM_OK: mov HEAD_3D[0], 'p' ; Change 'am' to 'pm'
AM_OK: call BIN_2_ASC ; Convert binary hours to ASCII
mov ax,bx ; Restore AX from BX
and ax,7e0h ; Isolate minutes field
mov cl,5 ; Align to AL register
shr ax,cl ; by shifting right 5 bits
inc di ; Minutes position in page header
call BIN_2_ASC ; Convert binary minutes to ASCII
mov ax,bx ; Restore AX from BX
and ax,1fh ; Isolate seconds field
inc di ; Seconds position in page header
call BIN_2_ASC ; Convert binary seconds to ASCII
ret ; Return to caller

STAMP endp

;
BIN_2_ASC proc near ; Convert binary number to 2-digit ASCII
 cbw ; Convert AL to word for division
 div BIN_ASC ; Divide AL by BIN_ASC (contains a 10)
 add al,48 ; Convert quotient (in AL) to ASCII
 stosb ; Store to location pointed to by DI
 add ah,48 ; Convert remainder (in AH) to ASCII
 mov al,ah ; Move to AL for store
 stosb ; Store to location pointed to by DI
 ret
BIN_2_ASC endp

;
CLOSE_FILE proc near ; Close file handle
 cmp FILE_HANDLE,0 ; If 0, no file open
 je CLOSEX ; Do nothing
 mov bx,FILE_HANDLE ; Move file handle to BX
 mov ah,3eh ; Request close file
 int 21h ; Call PC-DOS
CLOSEX: ret ; Return to caller
CLOSE_FILE endp
CSEG ends
end BEGIN

```

(Figure 1 ends.)

lower-case letters to upper case, all valid PC-DOS delimiters to blanks, forward slashes (/) to backwards ones (\), and strips off leading blanks. The results are stored in a memory area called FN\_AREA.

The variable FN\_LOC is used to store the correct position of the actual file name within FN\_AREA. If no disk drive or path specifications are used, FN\_LOC defaults

to the beginning of FN\_AREA. PR's parsing routine overrides this default if a colon (:) is found (indicating a disk drive), and this, in turn, will be overridden by the last backslash (\) found (indicating a path name). FN\_LOC is then used to store the file names found after PC-DOS functions 4EH and 4FH have been called to find the requested files in the specified (or default) disk drive and directory.

PR starts looking for files to print at label FINDF. If none are found, PR exits with an error message. Otherwise, flags are initialized, the file name is copied from the DTA (Disk Transfer Area) to the proper location in FN\_AREA, and PC-DOS function 3DH is called to open the file and assign it a file handle. If the open fails (possible only if you goofed coding the program or you're using a network and the



## PROGRAMMING

file is locked), PR exits with an error message.

### Doing the Printing

The real work of printing begins at label DO\_PR. Subroutine STAMP (discussed more fully below) is called to finish the page header data for each file, and PAGE\_HEAD is then called to print it. The logic that controls the file printing begins at label PRLOOP. Each time through, subroutine READ\_FILE is called to read data from the file, and subroutine PRINT is called to print it.

If the end of the file is found (see subroutine READ\_FILE for the method), PR falls through to label FINISH. (It jumps there if CX is zero when READ\_FILE returns.) Here, subroutine NEW\_PAGE is called to eject the last page, and subroutine CLOSE\_FILE is invoked to close the file. The program then looks for another file to print. If one is found, PR jumps back to label FOUND to start printing a new file. If no additional file is found, PR simply exits to DOS.

READ\_FILE uses PC-DOS function 3FH to read 256 bytes from the file. (READ\_LENGTH is set EQU 256 in the data declarations and is moved to the CX register here.) AX contains the actual number of bytes that were read when interrupt 21H returns. If it is less than CX (it will never be more), the end of the file was

reached. If AX is zero, there were no bytes left to read in the file. If CX and AX were not equal, the EOF\_FLAG is set to 1; otherwise it remains at 0. In any case, AX is copied for CX for use by the PRINT subroutine.

### Page Formatting

Subroutine PRINT formats the file into lines and pages. Each byte of the file is moved from the READ\_BUFFER to the PRINT\_BUFFER in the loop headed by the label FORMAT. Several things are checked within the loop, including how many lines have been printed on a page, how many characters are in the current line's print buffer, and whether or not a Carriage Return/Line Feed (End-of-Line) sequence has been found. Here, too, any tab characters are expanded to their standard ASCII positions (every eighth space). Whenever the line buffer is ready for printing (contains 80 characters or an End-of-Line sequence), PRINT\_LINE is called to print it. If a new page is needed (55 lines have been printed or a form feed is found), NEW\_PAGE and PAGE\_HEAD are called. The precise sequence of events in the FORMAT loop is critical for correct page and line formatting.

PRINT\_LINE prints the current line buffer using PC-DOS function 40H to write it to the standard printer device handle. (PRN is set EQU to 4 in the data dec-

larations.) The advantage of this technique (over the admittedly faster technique of using the BIOS printer interrupt 17H) is that this way PR.COM doesn't have to worry whether the printer is on or off. PC-DOS will inform the user if the PRN is not ready and issue its ubiquitous "Abort, Retry, Ignore" prompt.

NEW\_PAGE gets you to a new page by inserting a form feed character into PRINT\_BUFFER and then calling PRINT\_LINE. If a form feed character is already in the buffer (if, for example, you had put one in the file), it just calls PRINT\_LINE. Subroutine PAGE\_HEAD converts the current page number from binary to ASCII by calling BIN\_2\_ASC, strips off a leading zero (if any), and uses PC-DOS function 40H to print the page header data.

### Putting on a STAMP

Subroutine STAMP inserts the drive, path, and filename into the page header, locates the file's save date and time in the DTA, and converts them to ASCII characters by calling BIN\_2\_ASC. If you wish, you can get fancy at this point and use function 38H to determine which international format you should use for the date and time. On the other hand, after browsing through STAMP's TIME and DATE label sections, you may wish instead that PC-DOS would format the data for you.

```
-----*
| File: PR.ASM |
| Saved: 01-02-85 at 10:58:06 am |
|-----*
BIN_2_ASC proc near ; Convert binary number to 2-digit ASCII
 cbw ; Convert AL to word for division
 div BIN_ASC ; Divide AL by BIN_ASC (contains a 10)
 add al,48 ; Convert quotient (in AL) to ASCII
 stosb ; Store to location pointed to by DI
 add ah,48 ; Convert remainder (in AH) to ASCII
 mov al,ah ; Move to AL for store
 stosb ; Store to location pointed to by DI
 ret ; Return to caller
BIN_2_ASC endp
;
```

Figure 2: A sample of the program printout formatted by PR.COM.

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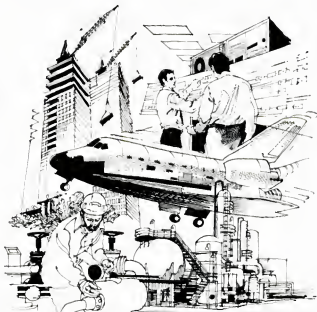
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## PROGRAMMING

BIN\_2\_ASC converts a binary number into two-digit ASCII character representation. It only works for numbers up to two digits, since most programs are shorter than 100 pages long. You can modify the routine to work for more digits, but if your page numbers exceed BIN\_2\_ASC's limit, you might be better off spending your time in a structured programming course.

Finally, subroutine CLOSE\_FILE uses PC-DOS function 3EH to close the open file handle.

## Additional Options

If you want, you can add options that will increase PR.COM's flexibility or change its formatting to accommodate your printer's special features or differences in your own programming style. For example, to print compiler listing files you might want PR to ignore its own page header and print 130 character lines using your printer's compressed print mode. Options will make for a longer program, but since this version only occupies about 1.8K of disk space (including almost 1K bytes of buffers and messages), the executable code of even an enhanced version will still not be excessively long.

Other things you might want to add to your PR.COM include a prompt to tell you what file and page number are being printed and the total number of lines printed. (You might even want to print this last number on the listing.) Some programmers like to see line numbers printed, so you might want to add that feature, too. Either of these last two possible options would require expansion of BIN\_2\_ASC to handle more digits.

You can have PR read the parameter string for options, or drive them with the current filename extension. For example, PR could print all .C and .ASM files with 80 character lines, and all .LST files with 130 character lines and compressed printing. The latter technique is easier to program and will work well if you're well set in your printing habits, but may be less flexible than you need. ■

# User-to-User

PC readers use this forum to help one another by passing along their questions, solutions, comments, and complaints.



## DOS FIND Sieves

The DOS FIND filter gives users a very fast way to retrieve information from large databases, document files, programs, or any ASCII file. But there's a way to make it even more useful.

Nesting FIND operations that redirect filtered output through a series of sieves makes it easy to carry out conditional search operations. This method is so efficient that some users may find this technique more effective than working through a database management program.

Until recently, I used the FIND command primarily to locate lines containing particular variables in FORTRAN or Pascal source-code files that were thousands of lines long, to create indexes of keywords in documents or to generate structural outlines of programs by searching for subroutine or procedure headings.

It was not until a fellow researcher raised the problem of searching a multi-megabyte database with an unusual struc-

ture that I realized the FIND command could be an effective tool for more complicated data retrieval operations. Most of the commercially available database managers I've tried did not meet my friend's needs; they were slow for large databases and were often limited to storing 128 or 256 variables for each case record.

My friend's database is already hundreds of variables large and is growing. The variables correspond to characteristics of microorganisms used in biomedical research. There are already over 6,000 different strains in the database, and the number is increasing each year. Furthermore, the existing structure of the database as transferred from handwritten index cards does not specify a strain's status on all of the possible characteristics; instead it lists the known and relevant properties in a specialized notational system.

When searching the database, my friend typically needs to find strains with specific combinations of properties. This can be done easily with the SEARCHUM.BAT batch file in Figure 1. If I wanted to retrieve from a client address file called CLIENT.DAT all cases in which the client is female, lives in Boston, and is self-employed, the command would be (all on one line):

```
SEARCHUM CLIENT.DAT
"female" "Boston"
"self-employed"
```

SEARCHUM.BAT first turns off the echoing of subsequent command lines to the screen. The first FIND command

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## USER-TO-USER

ties in the list be present simultaneously, you can structure the .BAT file so that you can find lines that contain any (i.e., logical OR) of a list of characteristics and then concatenate the accumulated files at the end with a COPY command. Or, you can tailor a search to detect some combination of jointly present and alternative conditions.

On a PC-XT, FIND can readily scan and report the presence of two instances of a unique character sequence located in the middle and at the end of a 7,000-line file (80 characters/line) in about 10 seconds. For ASCII files under a few thousand lines, the response seems instantaneous.

Andrew J. Pakstis  
New Haven, Connecticut

*It is possible to save a bit of keystroking by putting the quote marks in the batch file*

(e.g., %!1" rather than %1, "%2" rather than %2, etc.) so you don't have to type in the quote marks when beginning the search, but this works only if you're searching for single words. And FIND is case-sensitive, so you have to be sure your database doesn't contain the words female, Female, and FEMALE. But these are small complaints; this technique is a canny use of both DOS filters and batch files.

### Super CLS

There is a way to put 50 lines of 80 characters on a screen. When it is used normally, however, the CLS command will clear only the top half of the screen; the other half will not be affected.

The 50X80CLS.BAS program in Figure 2 contains a machine language subroutine that will clear the entire screen when

using the 50 × 80 mode. And by changing certain values in data statements, the program will let you clear any part of the screen in normal text modes.

Edison Hsu  
Glendale, California

*While the flickery 50 × 80 screen is not really very usable, the technique in 50X80CLS.BAS does work. However, the program's selective screen clearing trick in normal text modes is very useful.*

### Clear-Cut TREES

While the DOS TREE utility does show the structure of all the subdirectories on your disk, its display is not very clear. The TREEFIX.BAT batch file in Figure 3 redirects the DOS TREE output to a file, TREE1.LST, which is then processed by the BASIC TREEFIX.BAS program in



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Figure 4 to give you a much clearer picture of how your subdirectories are arranged.

To use this, you can either have TREEFIX.BAT and TREEFIX.BAS on the disk you want to examine and just type

TREEFIX

while in DOS, or you can specify a separate drive to examine, for instance:

TREEFIX B:

Bob Raven  
Catonsville, Maryland

We made some changes in the program to enhance its output, but the original idea works well. Be sure to either have TREE.COM and BASICA.COM on whatever subdirectory the two TREEFIX files are on, or have a PATH to TREE.COM

```
ECHO OFF
ECHO Now searching directory...
TREE X1>TREE1.LST
BASICA TREEFIX.BAS
```

Figure 3: The TREEFIX.BAT batch file that redirects TREE into a TREE1.LST file to be processed by TREEFIX.BAS

```
100 ' TREEFIX.BAS -- by Bob Raven -- adapted by PC
110 CLS:OPEN "I",#1,"TREE1.LST"
120 IF EOF(1) THEN CLOSE:KILL "TREE1.LST":SYSTEM
130 INPUT #1,A$
140 B$=MID$(A$,2,4)
150 IF B$<>"IREC" THEN 170 ELSE PRINT A$:PRINT "\(\ROOT)"
160 INPUT #1,A$;A$=RIGHT$(A$,LEN(A$)-6):GOTO 190
170 IF B$<>"Path" GOTO 120
180 A$=MID$(A$,8):K=0
190 FOR J=1 TO LEN(A$)
200 C$=MID$(A$,J,1)
210 IF C$="\" THEN K=K+1:D$=MID$(A$,J) ELSE 220
220 NEXT J
230 PRINT TAB(12*K-11);CHR$(124);STRING$(11,45);D$
240 K=K+1:IF K<21 THEN 120
250 PRINT "Hit any key to continue...";
260 IF INKEY$="" THEN 260 ELSE CLS:K=0:GOTO 120
```

Figure 4: TREEFIX.BAS processes the TREE listing prepared by TREEFIX.BAT.

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## USER-TO-USER

and BASICA.COM. Also, note that this technique will work with up to six levels of subdirectories; after that the display will wrap.

### Period-less Batch Files

User-to-User (Volume 4 Issue 2, page 318) asked why it wasn't possible to use a period instead of a REM for remarks in batchfiles. The mystery may be related to a new feature of DOS 3.0.

Under DOS 3.0, command files in a different subdirectory can be invoked by entering the pathname followed by the command filename. For example,

A>systemformat b:  
would execute FORMAT from the "system" subdirectory.

Of course, a period designates the "parent" of the current subdirectory. Thus, you could execute FORMAT from the next highest level in the tree by typing the following:

A>.\format

Since the period is a perfectly valid subdirectory name, it can no longer be used to designate a remark.

Walter J. Kenamer  
Cleveland, Ohio

*Sounds right to us. Anyway, it's not much more work to type in REM than "...", and periods can cause trouble in the first position of a line when you are creating batchfiles with WordStar. DOS keeps getting better and more powerful with each subsequent release; such additional typing is a small price to pay.*

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# PC Tutor

## Outgrowing Floppy Disks

**Q:** I have an IBM PC1 with 576K of RAM and two 360K drives. My database, however, already has 340K of data and is growing. How can I increase my storage capacity on floppy disks at low cost?



Could I hook up a quad-density drive without replacing the current disk controller card? How about the new 1.2MB drive in the PC AT?

George Wu  
San Francisco, Calif.

**A:** The simplest way to increase your storage density would be to substitute 96pi (quad density) drives. With appropriate software, this would double your disk density to 720KB. You can plug in a 96pi drive internally with no modifications to the PC, or attach it externally if you have an external power supply for the drive. Be careful in selecting a quad density drive, however. Often the 96pi drives can read from, but not write to, the standard IBM 48pi formatted disks. Similarly, of course, the 48pi drives cannot read 96pi disks.

Frankly, however, given the low cost of hard disks nowadays, I would seriously advise you to consider purchasing an

external or internal hard disk in preference to changing to a 96pi drive. Hard disks are faster and quieter than quad drives and have far more on-line storage. After all, your database may soon be larger than 720KB.

If you need to back up your large database from a hard disk, the IBM BACKUP routine works fine.

A final note: your PC1 may need a ROM upgrade to work with some of the newer, inexpensive hard disks. These new ROMs are available from IBM as part of their cluster controller and enhanced graphics controller upgrade kits.

## Alien PEEKs 'n' POKES

**Q:** I have three excellent TRS-80 computer BASIC programs, which I am converting for use on my new AT&T PC 6300. However, all three use PEEK and POKE statements to control paging for printed reports. What PEEKs and POKES do I use in GWBASIC?

Herb Kiessling  
Minneapolis, Minn.

**A:** I'd have an easier time answering this question if I had a bit more information. How, exactly, are you trying to control the pagination of your reports?

My best guess is that you are just trying to get the printer to generate a form feed to move on to a new page. This can be done in BASIC (or any other language) by sending the ASCII form feed code (12). In BASIC, you would enter

LPRINT CHR\$(12);

If you are trying to send some commands to the printer to set the page length of vertical tabs, however, you must use an escape sequence: a series of characters beginning with the escape character that

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## PC TUTOR

control print parameters. You can send an escape sequence using standard character string concatenation, as follows:

```
LPRINT CHR$(27) + "A"
```

This sends an escape character (decimal 27), followed by an A.

### How Much RAM?

**Q:** Is there a way to access the contents of the CS and DS registers of the 8088 to find the total amount of installed RAM,

from within a BASIC (compiled or interpreted) program? I need this information for a program that will POKE data into all unused memory. That would allow me to avoid overwriting the operating system, the BASIC program, or the 64K BASIC data area for any version of PC-DOS and any amount of system memory.

Barry Edelman  
San Antonio, Texas

**A:** I'm sorry to say I know of no way to find those values for the BASIC interpreter.

using DOS 1 or 2. DOS 3.0 has a function call to find the Program Segment Prefix (PSP), which is what you need, but I can't say more about it until I get adequate documentation.

Meanwhile, the primary problem seems to be that *USR* routines and function *CALLs* all go through IBM's BASIC-ROM setup. This makes it extremely difficult to find the default value of CS. You can determine the value of DS simply by checking it with a *USR* or *CALL* routine, but this is not sufficient information.

Certainly, you can take the DS value, add 64K to it (the maximum possible BASIC data area), and arrive at a figure for the top of interpreted BASIC memory. As for finding the absolute top of memory, however, I am not so sanguine. One way to do it is to use the BIOS call, *Int 12h*. While this will work for most programs (and PCs), it can't be recommended absolutely, as it may conflict with RAMdisk programs and print spoolers.

The BASIC compiler seems, moreover, to allocate memory differently, and there seems to be no way to allocate memory at the top of the PC's address space. As best I can tell, the compiler eats up all possible memory: some at the bottom (the program and run-time library), and some at the top (the stack and data).

### Using an Advanced Function Call

**Q:** I'm having a problem applying DOS function call 4Bh (load and EXEC a program) under DOS 2.0. The information in the IBM DOS manual is so ambiguous that even after trying a dozen approaches, all I get is the error message "Specified COMMAND search directory bad." I think my problem is in preparing the parameter blocks to which ES:BX must point.

Frank Barnes  
New York, New York

**A:** DOS call 4Bh is the *EXEC(ute)* call. It is used to execute one program from within another. The assembly listing in Figure 1 will serve as a model for discussion.

In this example I call the command

```
;code to demonstrate EXEC (4B) call
;this program does a diskcopy from A to B
;it sets error level -- 1 if load failed
;
CODE SEGMENT PARA PUBLIC 'CODE'
ASSUME CS:CODE
ASSUME DS:CODE, ES:CODE
proc test procedure
MAIN START: jmp GO
;exec parameter strings
PARAM DW (7) ;segment address of environment
 dw offset COMMAND ;command line
 dw CODE ;PCB number 1
 dw offset PCB2 ;PCB number 2
 dw CODE
 dw CODE
COMMAND db 17, 'C:\DISKCOPY A: &'.13, $;syntax
PROGRAM db 'A:\COMMAND.COM', $;file to call
PCB db 16 dup(0)
PCB2 db 16 dup(0)
;note that for the 4k (testblock) call you must
;leave ES alone (at PSP address)
;allocate 64k for the test program if possible
GO: mov AX, 4Ah ;sethltok call
 mov BX, 199h ;reserve 64kb for TEST program
 int 21h ;call DOS
 jc NOTENUP ;not enough storage
;read address (2C) of PSP to
;read/write the environment settings
 mov SI, 2Ch ;address of env segment
 mov AX, [SI] ;in PSP
 mov SI, offset PARAM ;leave it into parameter block
 mov CX, [SI], AX
;now prepare for the execute subprogram call (4B)
;for this call you need DS, ES:CODE as above, so...
 mov AX, CS
 mov DS, AX
 mov ES, AX
;now set up the register to point to the program name
;end parameter block
;then EXECute
 mov DX, offset PROGRAM
 mov SX, offset PARAM
 mov AL, 0 ;EXEC subtype
 mov AX, 4Bh ;EXEC
 int 21h ;call DOS
 jc LDERR ;carry = load/exec error
;if we got here, there was no error
 mov AL, 0 ;errorlevel 0
 jmp alldone
;load error
LDERR: mov AL, 1 ;errorlevel 1
 jmp alldone
;not enough memory
NOTENUP: mov AL, 2 ;errorlevel 2
;exit
 mov AX, 4Ch
 int 21h ;end of program
MAIN CODE
end
```

Figure 1: Assembly language program to illustrate DOS 2's EXEC function call (4Bh).

## PC TUTOR

interpreter (COMMAND.COM), which then interprets the command DISKCOPY A: B:. You'll observe that this command string is followed by a carriage return (13) and (to make it an ASCII string) a null. Note also that since neither of the two FCBs (file control blocks) is used by this invocation, they are left blank. You could build them if necessary.

PARAM is the parameter block that DOS requires. The first entry is the segment address of the environment. The calling program places the default environment (which is stored at offset 2Ch in the program segment prefix, or PSP) there. It is important to note that the PSP is the value of ES when a program is invoked. It must be saved early on (or never changed), since it cannot be calculated in any way through the use of DOS 2. In this example I assume both DS and ES have the value PSP, the standard invocation convention.

The main steps in the program are:

(1) Allocate 64K of memory. This is actually done by releasing any memory in excess of 64K from use by the called program. DOS programs begin by having all available memory allocated to them, and this step deallocates the extra. ES must be equal to the PSP for the SETBLOCK (allocate) call since we are deallocating a block at PSP.

(2) Read the default environment and store it.

(3) Invoke the COMMAND interpreter (EXECUTE it).

(4) Finally, exit using the DOS 2.0 hex 4C call (EXIT), which may also return an error value in the AL register. Since the CODE segment values are used in the parameter blocks, you cannot compile this listing down to a .COM file but should leave it as an .EXE program.

The PC Tutor solves practical problems and explains points of general interest. If you'd like to see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

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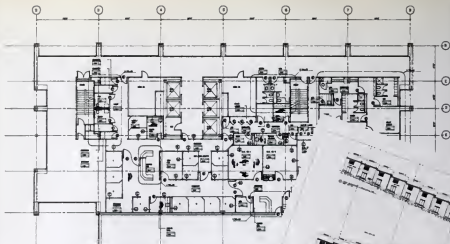
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# Training Students to Object

An NYU Law professor has combined laserdisk and PC technology to produce NYULIVE, courseware that teaches students the rules of evidence by realistically simulating a courtroom trial.

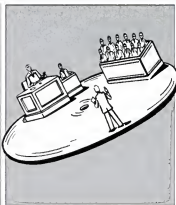
**T**he term computer-aided instruction has always conjured in my mind the image of an afternoon spent preparing for an exam staring at flickering green words in a dim library carrel while fighting off Morpheus with heavy doses of black coffee and candy bars.

Now that videodisks can be readily run by a microcomputer, a short course in evidence looks more like a scene with Veronica Hamel playing Joyce Davenport, Esq., on "Hill Street Blues" before she became the DA.

Many Thursday nights I felt like leaping to my feet in the living room to wag a finger at the television set and object that the prosecutor was asking for inadmissible hearsay.

Now I do exactly that, except that the lawyer on the screen is stopped cold as I touch the keyboard. The judge looks right at me and asks, "Counsel, what are the grounds of your objection?" I type in "hearsay."

She's a stickler of a judge, so she leans forward, peering over her glasses, and says to me, "Counsel, please be more specific. I don't understand the basis of your objection." I type in "hearsay within hearsay." Satisfied, the judge nods and says to me, "Objection sustained." I smile a triumphant smile. The drama rolls on.



## Videodisk Drama

Using an IBM PC and a laser videodisk player in combination, Professor Frank A. Bress of New York University Law School has put together 1-hour interactive program to help teach the basic rules of evidence to the students participating in a legal services clinic. He has tentatively named it the New York University Lawyering Skills Interactive Video-Computer Experiment, or NYULIVE for short.

Using two monitors, one for the images and voices from the laser videodisk and one for the instructional questions and text generated by a microcomputer, the program can solicit and record a stu-

dent's comments, answers, and questions. It saves Bress hours of time in coaching his clinical law students for a simple but real trial that they will handle as a part of their training.

Bress anticipates that by the time classes start this September, 15 to 20 law schools around the country will be using this computer-and-videodisk program as an adjunct to courses on evidence and clinical legal services programs.

## Levels and Modes

According to Bress, the program is set up to run at three levels, beginning, intermediate, and advanced. The student can choose the level. The lesson becomes more complex by increasing the number of objections it expects the student to make or by the degree to which the judge asks for clarifications. At the basic level it may accept "hearsay" as a sufficient objection. At the advanced level it expects the student to say that it is hearsay within hearsay and to explain what the two hearsay statements are.

As a student, you would start with an interactive mode, but you can switch to a research mode or a review mode at any point and then return to the interactive mode.

In the interactive mode, the trial scenario plays, and you can object when something objectionable occurs. The

program responds to your objection with a video sequence of the judge.

The program's branches go four levels deep, Bress says. For example, when your objection is sustained, the opposing lawyer will take a different path to try to get the same piece of evidence admitted. If you make another objection, the program will go to another branch and then another level. "It actually plays out the trial game much the way two lawyers in court would," says Bress.

After making an objection but before stating the grounds, you can shift to the research mode and call up a research library by pressing R. The computer screen then presents a menu of the program's available research tools, which include the federal rules of evidence, *McCormick on Evidence*, and a small body of case materials.

You can leave a comment to the professor at any point in the lesson by pressing C. It opens up a screen on the computer monitor where you can type in "I think this question doesn't make any sense, and the judge's ruling was wrong." The comment is recorded along with the frame number of the video so the professor can tell exactly where in the problem you were when you made the comment. After you have concluded your research, you can go back to the interactive mode, answer the judge's question, and the program goes on.

"One beauty of the research mode," says Bress, "is that a state reference module can be inserted in the lesson and later changed from state to state. The program can be made specific to any jurisdiction in which it's being used. If it's to be used in Florida, for instance, we can customize it to contain the Florida Code of Evidence."

### Performance Review

When you end the problem, the review mode is automatically invoked.

"We keep track of the video picture frame numbers," Professor Bress explains, "so when a student objects, we

have a record of where he objected. Later, we can go back and see if the student objected at the appropriate moment (when the objectionable buzz word is spoken), too soon (before it was clear that objectionable evidence was about to be presented), or too late (after the objectionable answer was given and heard by the jury)."

With this information, the program gives you an individual analysis of how you've done. "There were 350 places at which you properly could have objected. You objected only 250 times and, of those times, you objected improperly 50 times."

After seeing this, you know what you need to work on. You can choose an explanation of the court's ruling, a replay of the video, a transcript of the scenario, or a recapitulation of the objections and rulings during this segment.

For every ruling the court makes, the program contains a three-part explanation that analyzes what's going on in the case (such as why this statement is hearsay), a short summary of the law on the point, and the tactical considerations.

The replay lets you see the sequences where you missed objections and where your objections were wrong. The program reminds you of your original choice and lets you choose another response. For students more print oriented, choice 3 produces the text of the replay.

### Better Learning

Harvard Law Professor Donald Trautman says that computer-aided instruction is a supplement to classroom instruction rather than a substitute for it. "Where computer lessons are used by students before class, the classroom discussion is far better. Students can use the video lesson at their own pace to absorb how the rules work. With that foundation, the professor can spend classroom time exploring what's wrong with the rules, what direction the law should be moving in, and similar policy questions.

The overall learning process is far superior to what we do now."

### Course Production

The video material, images, and voices are recorded on a laser videodisk. The plastic-enclosed disk consists of 54,000 concentric circles on each side. Each circle holds one frame of video and audio information. Two sides with a total of 108,000 frames hold about an hour's worth of video material. Since each circle is randomly accessible, material seen and heard sequentially on the television screen can be drawn from a random order of circles.

After the images and voices are recorded on videodisk, Bress uses an ordinary IBM PC, souped up to 640K with an AST board, to control it. Professor Bress loads the floppy disk program onto a 368K RAMdisk for faster accessibility.

The text and other written information appear in colored windows on the computer monitor, sitting next to the color television screen featuring the video and audio parts of the trial.

Running on less than \$5,000 to \$6,000 worth of hardware, the videodisk, floppy disks, and manuals can be reproduced in quantity at a cost of less than \$50 per package. The program is not for sale at this point but will be made available to selected schools in exchange for cooperative developmental work.

The catch is the development cost, which Bress estimates can run between \$75,000 to \$150,000. The biggest expense is the time of the people who write the lesson scenarios. Then comes programming, the video production (about \$26,000 for actors, cameras, and equipment), and, finally, pressing a master videodisk at \$3,500.

This newest wonder of legal education will be on display at New York University April 19th and 20th at a conference for law school faculty members cosponsored by NYU Law School and the Center for Computer Aided Legal Instruction. ■

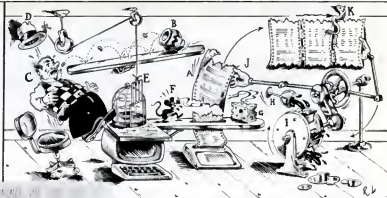


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In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality. The extra money might be going toward fresher advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality. All of the good manufacturers put out a good diskette. Period.

### How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality. There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers. Rather they're fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and passing their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5 1/4" diskettes. Same for DYSAK, Polaroid and many, many other familiar diskette brands. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star Diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvek sleeves, reinforced hubs, user ID labels and write-protect tabs.

**Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.**

In our search for the low price, high quality diskettes of our dreams, we found something even more interesting. We found that there are several manufacturers who don't give a hoot about the computer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

**Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.**

Well, that's the story.

Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

Super Star diskettes have been around for years...and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Super Star diskette. And maybe more than once, you've bought a box or two or more of Super Star diskettes without knowing it. They just had some "big" company's name on them.

Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds or thousands.

We buy them in the millions.

And then we sell them to you.

Cheap.

### When every little bit counts, it's Super Star Diskettes.

You've used them a hundred times...under different names.

Now, you can buy the real McCoy, the same diskette that major software publishers, computer manufacturers and diskette marketers buy...and call them ours.

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### The Super Star LIFETIME WARRANTY!

Super Star Diskettes are unconditionally warranted against defects in original material and workmanship so long as owned by the original purchaser. Returns are simple, just send the defective diskettes, postage paid by you with a short explanation of the problem, and we'll send you the replacements. (Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)

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# Personal Financial Planning: Three Aspects

Using three types of computerized financial-planning aids, you can create a complete system for assessing your current financial status and for choosing the right investments.

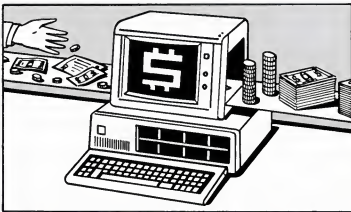
**C**omputerized personal financial applications have grown by leaps and bounds over the past 3 years. According to the American Association of Microcomputer Investors, more than 600 investor-related programs are available. And almost 40 of these are for personal financial planning. Such new and diverse functions as double-entry bookkeeping, automatic check writing, and financial-planning aids make these programs flexible. Although balancing a checkbook is still important, these other features let you do truly comprehensive financial planning.

## What's Needed

Most people need three distinct financial applications: status tracking, cash-flow planning, and analysis of alternatives.

For status tracking you use the data file you create when you enter check transactions to present a picture of your assets (what you own) versus your liabilities (what you owe). Subtracting the latter from the former yields your net worth—a frequently used indicator of personal wealth. Status-tracking programs also usually include a budgeting system, useful in controlling your income and expenses (cash flow).

In cash-flow planning, an automated budget can be helpful, but something



more is needed: entries for a monthly budget program that will help you project an ideal budget for a year. You can set up such a representative annual picture of your income and expenses using any spreadsheet or integrated program.

The third application you'll need is a separate financial analysis program to help you evaluate purchase or investment alternatives. They greatly simplify amortization depreciation and return investment computations.

## Personal Finance Master

I have used the *Personal Finance Master* from Spectrum Software in Sunnyvale, California, to track my finances

for the past 3 years. It is representative of other finance programs for the home and small business, and it includes two of the three functions needed for full financial planning. The accounts that you establish are the firms or individuals with which you have financial dealings. You identify each transaction with a purpose code and include the number, date, account and purpose codes, and the amount paid out for each checkbook or credit card transaction.

All entries are organized by month, allowing you to set up the program's budget module and compare the monthly budget-versus-actual figures by dollar amount or by percentage variance. You

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## BUSINESS

also can graph and compare up to six of your monthly expenditures at once.

The program can sort your assets and liabilities and compute your net worth for any selected month, a benefit when you want to borrow money for large financial projects such as home mortgages and boat and car purchases. Such major purchases or investments require an initial outlay of cash and often require periodic payments. Thus, you have two costs when you commit large amounts—upfront and ongoing. Knowing your liquid assets is important when handling upfront costs; understanding your cash flow helps determine whether you can pay the continuing costs.

### Spreadsheet Setup

Any spreadsheet program can give you considerable flexibility in structuring your income and expenses. The initial setup of the spreadsheet takes the most time. If you already have an automated checkbook-balancing program, you can print out the income and expense transactions. Otherwise, to set up the spreadsheet, sort through your paper records and manually record all your transactions. Divide your income into applicable categories such as salary, bonuses and commissions, interest and dividends, supplemental income, capital gains distributions, and so forth. Similarly, divide your expenses into household and living, insurance, medical and dental, financial, taxes and investments, and so forth.

Once you've collected and organized this data, make up a spreadsheet with 12 columns (one for each month) and identify the rows as the income and expense line items. For each month, enter the amount of money earned or spent. If you don't have the exact amount for every month, assume some amount and add in the actual figure when you update the plan. If you leave an entry blank, the program you're using will probably assume the entry is zero.

Have the last column total each row

for a yearly figure, and the last row total the columns. An additional column of the spreadsheet layout should give percentages. These percentages specify the relative contribution of the various income/expense elements to each other and to the bottom-line totals.

Cash-flow planning in this manner gives you an annual view of your income and expenses. If your expenses exceed 100 percent of your income, you have a debt problem. Whatever your situation, you can always improve your finances with automated cash-flow planning.

In *Personal Finance Master*, setting up your annual budget is simple once you have a complete cash-flow picture. Take the last month's income and expenses from the spreadsheet you set up and plug them into *Finance Master's* budget module. After entering transactions each month, you can compare the actual income and expenses to those you budgeted. Spending patterns will emerge. If the results deviate from your budgeted amounts, you can adjust your spending to bring them back into line. This way, you can plan cash flow annually and control it monthly.

### Financial Cookbook

Analyzing alternatives is as important as status tracking and cash-flow planning, and the *Financial Cookbook* from Electronic Arts in San Mateo, California, is one of the newest of these analysis programs. It differs from accounting and planning packages in that it essentially automates business calculator functions. Frequently, you need to compare mortgage rates and acquisition methods, IRAs and taxable investments, loan alternatives including interest rates and terms, and leasing with purchasing. The *Financial Cookbook* makes such computations easier than does a simple hand calculator.

Say you want to re-evaluate your IRA to coordinate it with some new long-term, taxable investment opportunities. You want to measure the spendable in-

come in case of early retirement.

Four of the program's "recipes" deal with IRAs: "Saving Money with IRAs," "An IRA's Future Worth," "Living from an IRA," and "Early Withdrawal from an IRA." By combining the "Future Worth" IRA recipe with ones for "Earning with Long-Term Investments" and "Understanding Your Marginal Tax Rate," I assessed the total return from both my tax-advantaged and taxable investments. Next, I plugged in the total return from both sources into the "Living from an IRA" recipe. This program computed the length of time the total balance would last (given an assumed monthly withdrawal, inflation rate, and the interest earned on the balance remaining after withdrawal).

Using a personal computer for this type of problem lets you quickly evaluate many alternatives with far less tedium.

#### Lumen's Entries

Two complementary programs from Lumen Systems, Inc., of Englewood Cliffs, New Jersey—*The Personal Financial Planner* and *The Personal Financial Manager*—can give you status tracking, cash-flow planning, and alternative analysis when used together.

*The Personal Financial Manager* is similar to other programs on the market in that it includes checkbook-balancing programs. It also allows a description and an updated inventory of your assets and liabilities, generates tax reports, tracks your budget, and maintains all financial transactions.


*The Personal Financial Planner* program is unique because it includes a variety of useful aids for analyzing financial data. If you use it with the *The Personal Finance Manager*, you can evaluate alternative tax strategies and insurance plans, relate your current investment strategy to your retirement and estate plan, prepare for your children's education, and track your net worth.

Computer financial-planning aids not only let you set up and maintain your

own financial data files, but they also let you analyze and interpret the data. When they are used with stock, bond, and real estate evaluation programs, you have a

complete system for assessing your current financial status and for choosing the right vehicles for both short- and long-range investments. ■

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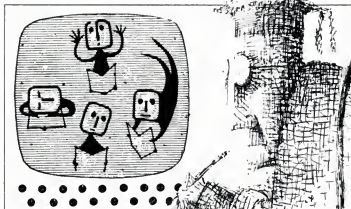
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# Teacher's Aide

The TenCORE authoring language allows teachers to create sophisticated instructional systems that can evaluate student responses and tailor themselves to meet student needs.



Since the early 1960s, behavioral and computer scientists have been working to develop technology to make instruction more efficient and effective. Behavioral scientists contributed the ideas of actively engaging the student in the learning process and of reinforcing instruction with positive feedback. Computer scientists recognized the potential of the computer to deliver this kind of instruction.

The *TenCORE* system is an example of the results of such a collaboration. Powerful and flexible, *TenCORE* can help in all phases of teaching from designing, developing, and producing courses to instructing, testing, and moni-

toring student progress. Best of all, the program can analyze student responses and tailor a course to their needs.

*TenCORE* was formerly known as *EnCORE* (see "Author, Author" *PC*, Volume 3 Number 10), but the name was changed for copyright reasons. Since then, substantial changes have been made to the program, and the manuals were completely rewritten. *TenCORE* was developed by Paul Tenczar and is based on Tutor, the authoring language he developed for Plato, his instructional system for mainframes.

The heart of the *TenCORE* system is a robust authoring language that has the capacity to branch and execute blocks of

instructions in various sequences according to student performance. Basically, the system creates screens for display to students and analyzes the responses.

When a student answers a question, *TenCORE* automatically checks the answer for spelling and capitalization errors, for extra or missing words, and for words out of order.

You can also program a variety of answer-checking commands to evaluate the student's response. Congratulatory messages can be given for correct answers, while contingent messages respond to wrong ones. You can even include hints and special help sections.

The program can use a list of synonyms for the correct answer so that all forms will be accepted. It can ignore designated words of the student's answer, or it can ignore all but the correct words. You can program it to ignore case where appropriate.

*TenCORE* can perform commands conditionally, depending on the value of a variable or expression. This allows it to branch to different units, depending upon how often the student answers the same question incorrectly or upon the total number of errors. The program can also handle student-initiated branching. You can program function keys to take students to supplementary units for additional instruction.

(continued)

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## EDUCATION

### Initial Options

When you start the *TenCORE* program, the main menu presents you with five options. The "Edit" option is where the development work takes place. "Lessons" takes the binary files, compiled as the final Edit step, and executes them for student use. The "Information" option, together with the help screens available at various points in the program, provides an on-line reference manual. "File Management" makes the DOS file functions available, and "Utilities" provides a variety of useful routines.

A course file is composed of blocks, or units. The Edit option takes you to the block directory, which shows you which blocks are available and allows you to add, delete, or edit a block. The source-code line editor lets you insert, replace, or delete lines of text, as well as scroll through text, automatically search for text strings, and save edited text. You can execute a source block and interactively debug when you see errors.

A separate graphics editor allows you to design box objects and line drawings for inclusion in a text file. The system can create graphics with the cursor key, a mouse, or a light-pen.

Another particularly valuable *TenCORE* feature is its ability to design special character sets for foreign language alphabets—including accent marks or special symbols—which can be



### TenCORE

Computer Teaching Corp.

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(217) 352-6363

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created in a variety of sizes.

*TenCORE*'s student records roster has a capacity of 30 student names, with a password for each student. The system tracks student progress by recording which lessons have been completed and the score on each. This information is available to both student and instructor.

The *TenCORE* package includes a system disk, an authoring disk, a utilities disk, and a manual for each. The manuals are clear and effectively arranged. Some information not found in the manual (especially for the graphics editor) has been put on the help screen. A good tutorial in the middle of the system manual takes you through the process of creating a source file, entering the lesson, testing and debugging, and preparing the binary file. Unfortunately, the tutorial does not use *TenCORE*'s own system to teach itself to new users.

The easy-to-install system can be operated from a hard disk, provided the copy-protected system disk is in the floppy drive when the authoring session starts. The system disk isn't required for the student sessions. But *TenCORE* does not permit you to write-protect the system disk, which is worrisome since write protection is a sensible precaution when you can't make backup copies.

The package includes self-adhesive labels for a number of keyboard keys. Some keys have been renamed, causing unnecessary confusion; for example, the program renames the Enter key as Erase.

### Author, Author

*TenCORE*'s authoring language is a special-purpose programming language, and the manual recommends that you learn it from someone experienced in preparing computer-delivered instruction. Thus, it may not be the right choice in all cases. For example, the teacher who wants to prepare a supplement to a conventional lesson should look for a simpler solution. For a large-scale project, however, the *TenCORE* system is a powerful and flexible tool. ■

# PC User Groups

This list is a partial directory of PC user group names and addresses. Use this listing to locate other PC aficionados who congregate in your area or around the world.

## GEORGIA

### **Middle Georgia Computer Club**

c/o L. Keith Dantzler  
P.O. Box 5705  
Macon, GA 31208  
(912) 477-7009

### **Microteers PC Users Group**

c/o Sandra Mitchell  
300 Boulevard, N.E.  
Atlanta, GA 30312  
(404) 653-3532

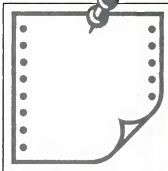
### **Athens IBM-PC User Group**

c/o Hugh Christian  
255 South Milledge Ave.  
Athens, GA 30605  
(404) 549-6222 (day)  
(404) 543-0139 (night)  
Bulletin board: 404-546-0583

## HAWAII

### **Hawaii IBM PC Users Group**

c/o Dick Colven  
P.O. Box 22967  
Honolulu, HI 96822



### **IBM PC User Society**

c/o Arthur W. Becker, Public Affairs  
Box 591  
Pearl City, HI 96782

### **Waikiki PC User Group**

c/o Lyle Jalier  
P.O. Box 15911  
Honolulu, HI 96815

### **Maui PC Users (MPCU)**

c/o Michael Skolnick  
P.O. Box 1760  
Kihei, Maui, HI 96753  
(808) 879-8168

## IDAHO

### **Idaho PC User Group**

c/o Bruce Burns  
ComputerLand  
687 S. Capitol Blvd.  
Boise, ID 83702  
(208) 344-5545

## ILLINOIS

### **Association of Personal Computer Users (APCU)**

323 South Franklin, #804  
Dept. A-202  
Chicago, IL 60606

### **Chicago Computer Society**

P.O. Box 95625  
Hoffman Estates, IL 60195

### **Corona and Other PC Compatibles Users Group**

c/o Dan S. Tong  
1310 Maple Ave.  
Evanston, IL 60201  
(312) 864-7549

PC will publish a periodic listing of PC user groups. Send new addresses or address changes to "Club News," PC, One Park Ave., New York, NY 10016. New groups and address changes are shown entirely in **boldface**.

## CLUB NEWS

### Central Illinois PC Users' Group

c/o William J. Crampon  
P.O. Box 3351  
Springfield, IL 62708  
(217) 787-1948

### Loop & Lakefront IBM PC Users Group

c/o J. A. Tanenbaum  
336 W. Wellington  
Chicago, IL 60657  
(312) 248-1774

### 1-PUG

c/o Roger A. Peterson  
2805 N. Easton Pl.  
Peoria, IL 61604  
(309) 688-4695

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## INDIANA

### ComputerLand User Group

c/o Susan Shields  
ComputerLand  
5450 N. Coldwater Rd.  
Fort Wayne, IN 46825  
(317) 259-7892

### Muncie PC User Group

2809 E. Jackson St.  
Muncie, IN 47303

### Northern Indiana IBM PC Users Group

c/o Dr. Terry Alley  
316 N. Ironwood Dr.  
South Bend, IN 46615  
(219) 289-5506

### Notre Dame PC User Group

c/o Paul E. W. Hemmeter  
P.O. Box 597  
Notre Dame, IN 46556  
(219) 239-5295

### The North East Indiana IBM-PC Users Group

c/o George Gynn  
9904 Goshen Rd.  
Ft. Wayne, IN 46818  
(219) 693-3147

### Terre Haute PC Users Group

P.O. Box 3174  
Terre Haute, IN 47803

### IBM PC Users Group, Inc.

P.O. Box 2532  
Indianapolis, IN 46206  
c/o Mike Cabat

### Southwestern Indiana IBM PC Users Group

P.O. Box 4874  
Evansville, IN 47711  
(812) 479-7790

### PC Bloomington Area User Group

c/o Michael L. Hoyt  
Rt. 2, Box 65  
Solsberry, IN 47459  
(812) 825-7384

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## IOWA

### Cedar Falls User Group

c/o Lee Ann Moore  
Black Hawk Village Shopping Center  
Cedar Falls, IA 50613

### IBM PC Users Group

P.O. Box 246  
Des Moines, IA 50301  
Attn: Gary Wilcox  
(515) 967-5880

### Hawkeye-PC

c/o Ben Blackstock  
385 Collins Rd. N.E., #201  
Cedar Rapids, IA 52402  
(319) 393-5416  
Bulletin board:  
319-363-3314

### Quad Cities PC Users Group

c/o Lew Roberts  
P.O. Box 464  
Bettendorf, IA 52722  
(319) 391-9437

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## KANSAS

### Topeka Library User Group

c/o Becky Hinton  
Topeka Public Library  
515 W. 10th St.  
Topeka, KS 66604

### IBM Users Group of Lawrence

P.O. Box 1403  
Lawrence, KS 66044

### Wichita IBM PC Users Group

P.O. Box 18422  
Wichita, KS 67218

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## KENTUCKY

### Kentucky-Indiana Personal Computer Users' Group

c/o Robert D. Hastings  
P.O. Box 3564  
Louisville, KY 40201  
(502) 589-0254  
Bulletin board: 6 p.m. to 9 a.m.  
(502) 896-4419

### Bluegrass IBM PC Users Group

c/o Diane Skoll  
Computing Center  
Rm. 72, McVey Hall  
University of Kentucky  
Lexington, KY 40506-0045  
(606) 257-2900

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## LOUISIANA

### The Baton Rouge PC Users Group

c/o Tom Wichser  
3375 King Bradford  
Baton Rouge, LA 70816

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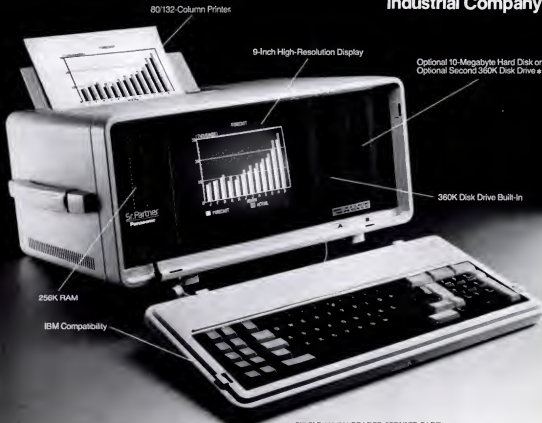
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# New On The Market

## HARDWARE

### ASC-88 SCSI-IBM PC Host Adapter

An adapter board permitting the IBM PC user to connect peripheral equipment using the proposed SCSI (Small Computer Systems Interface) standard. The ASC-88 adapter includes an ASC-BIOS PROM that enables the board to directly emulate fixed disk BIOS commands, as well as allowing the user to access connected devices through the SCSI command set.

Configuration software is provided containing utilities to connect any SCSI (or SASI) controller/drive combination to the system. This allows the user to configure a system without limits on the maximum amount of disk space. It also permits the user to designate the boot device, and to partition large disks into smaller logical volumes. Configuration values are stored in nonvolatile RAM on the board and are software controlled.

The ASC-88 Adapter is a full implementation of the proposed SCSI standard, with provisions incorporated for compatibility with a proposed extension to the standard allowing up to 64 devices on the single bus. Other features of the board in-

clude support for overlapping disk operations and Direct Memory Access (DMA) transferring. (List Price: About \$250) *Advanced Storage Concepts, Inc.*  
9660 Hillcroft, #325  
Houston, TX 77096  
(713) 729-6388

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### Toshiba Automatic Feeders

An automatic cut-sheet feeder and a bidirectional tractor-feed unit for the Toshiba p1351 letter quality printer. The sheet feeder, capable of handling both letter and legal-size paper weighing 15-25 pounds, can accommodate 170 sheets of paper.

The Toshiba bidirectional tractor-feed mecha-

nism can handle super- and subscript printing, with single and multiple-part forms. It can also perform bidirectional printing with both scripts without speed degradation.

(List Price: Sheet feeder, \$995; Tractorfeed, \$195) *Toshiba America, Inc.*  
2441 Michelle Dr.  
Tustin, CA 92680  
(714) 730-5000

CIRCLE 779 ON  
READER SERVICE CARD

### Concept Laser 8

A laser printer compatible with both the IBM and the Virtual Device Interface (VDI) interface standards. The Concept Laser 8 is capable of printing at resolutions up to 300 dots per inch, and at speeds up to eight pages per minute.

The printer prepares

camera-ready documents in a variety of fonts and on paper of various sizes and types, including postcards and transparencies. A multi-user option permits the printer to support up to four users.

Five modes of operation are available to the user. These include:

- VDI Graphics (based on the ANSI GKS standard), allowing the user to program the printer's output using high-level commands such as "fill polygon" or "draw polyline." This mode can also merge graphics with text within documents.

- Tektronix 4014 Emulation, allowing the printer to be used with Tektronix Plot 10, ISSCO DISSPLA, TELL-A-GRAF, and other software.

- Diablo 630 Emulation, for letter-quality output and compatibility with popular word processing software.

- ANSI X3.64 Terminal Emulation, allowing programs that drive this type of terminal to treat the printer as an output device.

- Bit Image Mode, providing the user with a direct path to producing bit-mapped graphics.

(List Price: \$7,995) *Concept Technologies, Inc.*  
6950 P.O. Box 5277  
Portland, OR 97208  
(503) 684-3314

CIRCLE 791 ON  
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Toshiba Automatic Feeders, Toshiba America, Inc.

**<MICRO-GUARD>**

A plug-in system security board for preventing unauthorized access to data stored in the user's PC. <MICRO-GUARD> features include a dedicated microprocessor, a password-protected clock/calendar, and on-board logic and memory with independent power supply.

The board includes an enhanced version of Westford System's <MICRO-TRACK> software, which provides a system use-reporting facility in the form of an Event Log containing a record of events such as power on/off, logon/logoff, keystroke count, tamper detection, and other selected events. (List Price: \$595)

**Requires:** 128K RAM.

Omni Marketing  
Concepts, Inc.  
P.O. Box 613

Lindenhurst, NY 11757  
(516) 789-0909

CIRCLE 794 ON  
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**COM-8 Board**

A plug-in board allowing the IBM PC-XT or PC AT user to add eight individually addressable serial ports via a single expansion slot. COM-8 boards can be chained together to enable a system to support as many serial terminals and peripherals as the system's memory capacity and operating system



COM-8 Board, Digigraphic Systems Corp.

will allow.

Another version of the board, the COM-4, provides four serial ports. (List Price: COM-4, \$309; COM-8, \$629)  
Digigraphic Systems Corp.  
10273 Yellow Circle Dr.  
Minnetonka, MN 55343  
(612) 935-9111

CIRCLE 788 ON  
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**SOFTWARE****CO-Graphics**

A graphics interface to the Micro Focus Professional COBOL and the High Performance Level II COBOL compilers, enabling the programmer to generate graphics directly from a COBOL program. The programmer can write COBOL applications that produce graphs and charts with data read directly from conventional COBOL data records, without requiring hardware-specific systems interfaces.

The CO-Graphics software provides the user with access to Graphics Soft-

ware Systems (GSS) graphics routines, based upon the Virtual Device Interface (VDI) standard. Capabilities of the program include the drawing of graphics primitives such as bars, circles, arcs, pie slices, polyline, polymarker, and text; attribute definitions, including full color support, fill styles, and line styles; and the ability to accept input from a range of devices such as digital mice, digitizing tablets, keyboards, and joysticks.

A runtime module is available separately for developing standalone COBOL applications.

(List Price: \$250; Runtime module, \$80)

**Requires:** 256K RAM, two disk drives, PC-DOS, Professional or High Performance Level II COBOL Compiler.

Micro Focus Inc.  
2465 E. Bayshore Rd.,  
#400  
Palo Alto, CA 94303  
(415) 856-4161

CIRCLE 777 ON  
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**SIGNART**

A graphics program for generating sideways-printed text in character sizes from 1/2 inch to 6 inches.

SIGNART offers four different fonts for signs, as well as a built-in Graphics Editor to generate special symbols, logos, and user-created character sets. The sign fonts included are Sans Serif Regular, Sans Serif Condensed, Serif, and Decorative. Through the Graphics Editor, the user also has access to the complete extended ASCII character set.

The text of a sign, as well as instructions relating to character size, style (regular, semibold, or bold), color, and line placement are entered through a simple editing screen. Once a sign has been created, it can be viewed before printing. Multiple copies can be printed at one time, and created signs can be stored to disk for reuse.

SIGNART is compatible with printers from IBM, Epson, and Okidata. (List Price: \$49.50)

**Requires:** 128K RAM, one disk drive, PC-DOS, color/graphics adapter, compatible printer.

TechART Associates  
1552 Sacramento St.  
Berkeley, CA 94702  
(415) 525-0870

CIRCLE 773 ON  
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## SOFTWARE

### VITAL RECORDS

A home-oriented database management system designed to organize important personal records efficiently. The user can enter data into 17 different categories, including assets, banking records, credit and liabilities, wills, securities, taxes, insurance, and others. The program is menu driven and can be modified as needed by the user.

(List Price: \$29.95)

**Requires:** 64K RAM, one disk drive, PC-DOS.

*Home Software Systems*  
P.O. Box 381557  
Germantown, TN 38183

CIRCLE 783 ON  
READER SERVICE CARD

### PhasorCode

A software-based privacy system preventing unauthorized access to data stored on the user's system. A separate option allows the program to transmit encoded files to or from the user's system. The program uses a two-key encryption/decryption process to scramble the message into an unintelligible string of characters. The message can be deciphered only by the authorized recipient by using the decryption key.

*PhasorCode* allows the user to establish personal encryption and decryption keys, which are automatically listed in the program's key directory. The



*PhasorCode, International Phasor Telecom Ltd.*

encryption key—which cannot be used to read messages—is publicly available, allowing anyone to send confidential messages to the user. The decryption key remains confidential.

As an added measure of security, *PhasorCode* allows the user to establish a password that locks the decryption key.

(List Price: \$495; Communications Version, \$595)

**Requires:** Basic Version: 256K RAM, one disk drive, PC-DOS 2.x. For Communications Version, add modem.

*International Phasor Telecom Ltd.*  
P.O. Box 396  
Claremont, CA 91711  
(714) 624-4010

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### Bisync Exchange Series

Two new additions to the manufacturer's *Exchange*

Series of communications programs. The new programs, *Bisync Exchange 3270* and *Bisync Exchange 3780*, add binary synchronous communications capabilities to the *Exchange* software line.

*Bisync Exchange 3270* enables the user's system to communicate with IBM 327x mainframe systems as an IBM 3274/76 cluster controller, an IBM 3278/79 terminal, or as an IBM 3287 printer. *Bisync Exchange 3780* emulates an IBM 3780 or 2780 terminal, with the ability to communicate with other PCs at 4,800 bps over voice grade or leased phone lines. An automatic error-recovery feature ensures that transmission errors are detected and corrected.

Other programs in the *Exchange Series* offer SNA and async communication capabilities.

(List Price: *Bisync*

*Exchange 3270*, \$795; *Bisync Exchange 3780*, \$695)

**Requires:** 256K RAM, two disk drives, PC-DOS, bisynchronous communications board, modem.

*Intelligent Technologies International Corp.*

151 University Ave.  
Palo Alto, CA 94301  
(415) 328-2411

CIRCLE 786 ON  
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### For Your Eyes Only

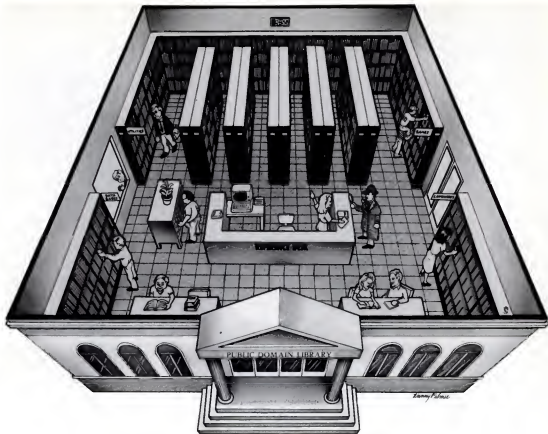
A file-protection program capable of encrypting any type of file on floppy or hard disk, with subdirectory support. The proprietary data-encryption algorithm used by *For Your Eyes Only* employs a 560-bit encrypting code, as opposed to the 56-bit code used in the widely-accepted DES standard.

*For Your Eyes Only* can protect over 100 individual files with the same password in a single operation; an entire subdirectory can be protected at once, without naming its constituent files. Alternatively, files to be protected can be selected individually from the program's directory listing.

Files protected by *For Your Eyes Only* are automatically hidden from view and will not appear in a DOS directory listing. These files appear only on the program's directory listing.



# REFERENCE DESK SOFTWARE



## The Brightest People Find the Best Sources

Even before PC's some of the most valuable information was free—at the library. In the computer age the most valuable information is software, and some of the most valuable software is also free—public domain software.

Both sources of free information can expand your horizons and save you hundreds, even thousands, of dollars—if you can find what you need among the vast amount of information available. When information overload leaves you clueless, the trick is to get pointed in the right direction by someone who knows the territory. The rest is elementary.

At the library or at your keyboard, when you need guidance in your quest for valuable information, your best resource is the **reference desk**.

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J.RAM-2X memory board OK expandable to 2MB.....

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CAPTAIN—64K.....  
**64K Memory Upgrade Set**.....

## MODEMS

**ANCHOR AUTOMATION**  
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**NOVATION**  
1200 + Internal.....  
1200 + External.....  
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1200 Plus-External 3001/200.....

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BoB board for 440.....  
420-RGB color.....  
425-RGB color.....  
122-12" TTL - Amber for PC.....  
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TATUNG 13" RGB.....

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| IBM 5 1/4" (10 pk.)    | SS/DD | DS/DD |
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| FUJII 5 1/4" (10 pk.)  | 17.95 | 24.95 |
| NASHUA 5 1/4" (10 pk.) | 15.95 | 17.95 |
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HR-25 23 CPS.....  
HR-35 36 CPS.....  
Tractor Feed (HR-15, HR-25, 124).....  
Sheet Feeder HR-15/25.....

**DIABLO**  
630 AP V-155.....  
Tractor Feed.....  
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**EPSON**  
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FX-80.....  
RX-80.....

**JUKI**  
6100 18 CPS Letter Quality.....  
6300 40 CPS.....

**NEC**  
8850 letter quality.....  
8550 letter quality 33 CPS.....  
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OKI-92.....  
OKI-84.....

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**APPLIED SOFTWARE TECH**  
Versaform XL.....

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Ashton Tate D BASE III.....  
Ashton Tate Framework.....

**BILL BRIGHT ROBERTS**  
Graphix Partner.....

**BORLAND**  
Turbo Pascal.....  
Side Kick (protected).....  
Side Kick (non-protected).....

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Time Line.....

**BRODERBUND**  
Bank Street Writer.....

**DOW JONES**  
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Market Microscope.....  
Spread Sheet Link.....

**DAYLLO**  
Daylio 1.1 (K71256K).....

**ENERTRONICS**  
Energraphics (req. color card).....

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Dutil.....  
D Graph.....  
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R Graph (for R base 4000).....

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Sideways.....

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New! Total Project Manager.....

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TEAC 558 Half Height DS/DD disk drive.....

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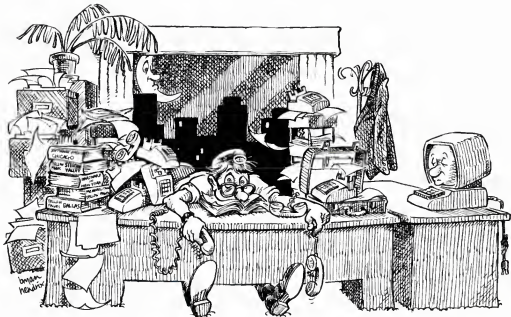


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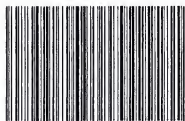
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1. Open the foldout page
2. Insert this sheet with
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

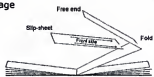


GbsSlipSheet-001

Folded edge of the page

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1. Open the foldout page
2. Insert this sheet with
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1. Follow instructions on the other side

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Framework

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# Artificial Intelligence: The Quest Continues

Into the Heart of the Mind and The Super-Intelligent Machine offer insights into the personalities, problems, and possible future of artificial intelligence research.

It is said that a certain medieval pope, after a tour of a new cathedral, turned to the master builder and pronounced his judgment in three words: "Awful, pompous, and artificial." At that time, it was the nicest thing he could have said: the work of the builders inspired awe, embodied pomp, and reflected great artistry.

Today, we prefer our awe in the form of a Steven Spielberg movie, and the word *artificial* has taken on a different meaning. With the exception of bioengineering, nowhere is the modern ambivalence toward our own creations more apparent than in the debate over artificial intelligence. And never has this ambivalence been better documented than in Frank Rose's new book, *Into the Heart of the Mind: An American Quest for Artificial Intelligence*.



*Into the Heart of the Mind: An American Quest for Artificial Intelligence*

Frank Rose

Harper & Row

10 East 53d Street

New York, NY 10022

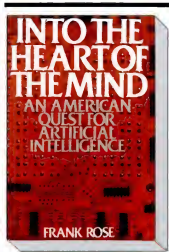
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Similar in style to Tracy Kidder's *The Soul of a New Machine*, Rose's book takes the reader into an AI lab on the Berkeley campus. By peering over the shoulders of Dr. Robert Wilensky and



his graduate students, you see first-hand the day-to-day sweat and toil involved in building miniature mechanical minds.

Based on a series of articles from *Esquire* magazine, *Into the Heart of the Mind* relates the background, talents, and secret dreams of each of the players on the Berkeley AI team, as well as their

feelings about receiving their funding from the Pentagon.

More to the point than these anemic slices of real life are the beefy slabs of computer history sandwiched in between.

## Chinese Quandary

Most of AI's cognoscenti appear in one scene or another, and although Rose doesn't have an ax to grind about AI, he has a brilliant understanding of the axes these characters wield. He discusses AI theoretician John Searle's famous "Chinese Room" argument: Suppose an American were locked in a room and given instructions for processing slips of paper. The instructions would specify character changes, which would turn out to be answers—in Chinese—to questions he had been asked. You certainly couldn't say the man had learned Chinese, Searle argued, yet AI researchers claim that computers are learning to "think" just because they perform similar mechanical manipulations of words and sentences.

As a proponent of AI, Berkeley's Wilensky points out this flaw: The comparison of the man in the room to a central processor in a computer system is a limited one and does not take certain interactive qualities into account. A computer system as a whole can run pro-

## BOOK REVIEW

grams, route messages, print reports, and communicate with operators. Similarly, people display "emergent" properties that cannot be explained in terms of scientific absolutes. Nobody really knows why, but complex systems are usually more than just the sum of their parts.

### A Simulating Question

Searle also pointed to arcade games to elucidate his views: can a computer simulation of war come anywhere close to the real thing? Wilensky retorts that sometimes artificial simulations do come close to reality. An airplane in a wind tunnel isn't experiencing real winds, but from the plane's point of view, what's the difference?

Naturally, a faulty argument does not a thesis disprove. But the real challenge

facing Wilensky and other AI adherents is not whether they will create "true" intelligence. The point is to keep trying and see what happens.

## Into the Heart of the Mind conveys the intellectual fervor of AI research.

*Into the Heart of the Mind* conveys the intellectual fervor of AI research. There are places in the book where you're not sure what Rose means, and you're not sure he does either. But that's part of the point he's making: researchers won't really understand artificial intelligence until they have come to understand human intelligence.

### The Super-Intelligent Machine

Adrian Berry is the science correspondent of London's *Daily Telegraph* and the author of several popular science books including *The Next 10,000 Years* published by The New American Library. In his latest book, *The Super-Intelligent Machine*, he is unabashedly optimistic about the future of AI; in fact, it seems to be his calling to tell us how great the future is going to be. This kind of hopeful outlook usually appeals to me more than prophecies of doom, but here the sentiment doesn't go very deep.

Berry knows his readers well. He is adept at explaining high school science concepts in elementary school terms. Since he has used a personal computer for several years, he knows there's really nothing mysterious about them, and his explanations of how they work are just

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## BOOK REVIEW

right for his purpose. It's only when he approaches controversial issues that he falls short.

For one thing, you'll learn very little about intelligence from *The Super-Intelligent Machine*. For instance, Berry discusses the amusing development of *Eliza*, the program that pretends to be a

on the technical curiosities he knows so well and rarely raises issues that are at the cutting edges of scientific thought.

*The Super-Intelligent Machine* is ex-

cellent pop science from a lucid writer, and it makes for fine weekend reading in the hammock under the shade tree. Tennis, anyone? ■

### You'll learn very little about intelligence from The Super-Intelligent Machine.

psychiatrist, but gives little technical information about the program.

As to the possibility of using computers to help run our lives, he states that running a government is less complicated than playing chess and will be relegated to machines in a hundred years or so.

#### Off the Track

Rather than directly discussing computer technology, Berry echoes themes from his earlier books: people living in transgalactic spaceships and humans being replaced with intelligent machines that are more "fit to survive." It's not my particular fantasy, but it's certainly imaginative. In another digression, he makes the surprising statement that if the universe is closed, it will implode within 50 billion years.

Otherwise, however, he concentrates

**The Super-Intelligent Machine: An Electronic Odyssey**  
Adrian Berry  
Jonathan Cape Ltd.  
Merrimack Publisher's Circle  
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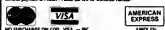
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# The Ins and Outs of Indexing

Even seasoned writers may shrink from creating an index, but the Micro Indexing System eases the task by treating entries like individual index cards on a computer screen.



If you've ever written a nonfiction book, you've probably faced the problem of creating an index. Professional indexers charge from \$1.50 to \$2 per page of text for the index, and unless your publisher is generous, this cost is likely to come out of your royalties. Thus, you wind up spending 30 or more hours producing the index yourself or paying someone else hundreds of dollars to do it for you.

The various methods of computerizing the task, such as using a database or word processor, are feasible but cumbersome and fail to take full advantage of the capabilities of your computer. However, a specialized indexing program, *Micro In-*

*dexing System (MIS)*, is now available for indexers. While the \$600 cost of the program is rather hefty, it should be amortized over the indexing of just a few books. The program is simple to use flexible and produces indexes following *The Chicago Manual of Style*. In addition, the manufacturer provides 6 months of free user support.

*MIS* transfers the process of typing index entries on individual cards to the computer screen. It divides the screen in half, reserving the top part for a display of the previously entered record and leaving the bottom half open for the entry of the newest record. You enter information just as you would on a card, by first

typing the main heading. If there is no subheading, you key in the page reference and then press the F10 key, which completes the record. If there is more information for the record, pressing the Enter key causes an automatic indentation on the next line for the subheading. A second strike of the Enter key indents the next line for a sub-subheading if needed. Pressing the Enter (or F10) key a third time completes the record, assuming you have also keyed in a page number.

Forgetting to give the page number causes a failure message and a warning beep. This is extremely helpful, since there's nothing more frustrating than finding the page number missing for a reference when the work is supposedly done and it's time to type the final index copy. After about ten records, the information is saved to disk.

*MIS* makes extensive use of the PC's



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**Requires:** 128K RAM, two disk drives, or one disk drive and a hard disk.

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## WRITING

function keys. In addition to F1 through F10, F11 through F20 are invoked with the Shift key. While entering text, you can mark it with other function keys to underline, boldface, subscript, superscript, and enter typesetting codes. "See" and "See also" references are generated from function keys.

Two other function keys deal with the common problem of number sorting before letters. In printed indexes, numerals are alphabetized as if they were spelled out. *MIS* allows you to mark text to be ignored in sorting and text not to be printed. To make 25th Street fall in the T's, you simply mark the "25" to be ignored in sorting and spell out "Twenty-fifth," marking the latter not to be printed.

A number of built-in features speed up indexing. Pressing the F1 key recalls the previously entered heading, F2 recalls both heading and subheading, and F3 recalls heading, subheading, and sub-subheading. The previous page numbers are not recalled, which saves retyping duplicate entries that occur on succeeding pages. If you're entering a subheading under several different main headings, you can recall the first heading and subheading, enter the new page number, move back to the unwanted main heading with the Home and cursor keys, and type in a new main heading.

You can also stop at any time to list the records alphabetically or in order of input, find any previously entered information by main entry, and delete or update (edit) any individual record.

When you have input all your entries, a separate menu lets you choose the method of alphabetization—word by word (as in a library card catalog) or letter by letter (telephone book). You can select how far you want subentries indented, how many lines between each entry and alphabetical block, and whether you want the final index indented (each sub- and sub-subheading indented under its parent) or run in (subheadings in paragraph form under the main heading). Finally, the program can generate

output either in *WordStar* or *MIS* format.

*MIS* does not require you to use a word processing program to edit the final copy. However, because *MIS* lacks such useful features as block moves or search and replace, a word processing program will save considerable time when extensive editing is needed.

Main and subheadings may be of any length, but the total record length cannot

---

### MIS does the job it's designed to do with a minimum of fuss.

---

exceed ten lines on the screen. Fortunately, it would take an extremely complex and wordy index to reach this maximum.

During index term entry, the Ins and Del keys can be used for simple changes. The Home and End keys move you to the beginning or end of a line. If the record has already been entered, Esc will take you to the main menu for access to the update feature. Updating a record means recalling it to the screen and making the desired changes.

During the sort process, the data is alphabetized and concatenated. If you made multiple references under "Modem" on pages 15, 38, 57, and so on, the program will bring these entries together, eliminate the duplicate headings, and put the page references in numerical order. *MIS* does the same thing with subheadings, then alphabetizes the subs under the main heading.

The sorting process is somewhat slow. However, there is an on-screen estimate of time remaining to sort and, in the last phase, a slowly rising thermometer gives you a picture of expected completion time. This process is much faster if you have a RAMdisk of sufficient size to hold the index while sorting.

A separate utility program allows you to build indexes larger than the current

9,000-record limit by creating smaller indexes that can be merged later. Another program permits a sorted and edited index file to be separated back into individual records—useful for updating the index of a second edition.

The program supports a color/graphics monitor. A menu allows selection of different foreground and background colors. This option comes in handy if your books require separate indexes, such as an author index and a subject index. If you use a program called *Memory Shift* from North American Business Systems in St. Louis, you will be able to run two indexing programs at the same time, changing back and forth simply by pressing two keys. However, this can be confusing without a way to remind you which index is active at the moment. By defining different background and foreground colors for the two indexes, you can avoid this confusion.

Another program that speeds up data entry is *ProKey* from RoseSoft, Inc., in Seattle. *MIS* includes the ability to assign terms to a number of different keys, but not nearly as many as *ProKey*. However, *MIS* may be enough for your needs.

Peter Mugglestone, author of *MIS*, is continually upgrading the program and adding new features as suggestions come in from the growing user base. Past updating policies have been extremely liberal. He is also working on a professional version with advanced features of interest to professionals doing dozens of books a year.

*Micro Indexing System* does the job it's designed to do with a minimum of fuss (I found no bugs) and produces a thoroughly professional product. If you're a professional writer or indexer interested in saving time and money over the long run, it's well worth the price. ■

---

*Charles Anderson, a professional librarian and information broker, is president of Answers Unlimited, Inc., a Chicago-based firm that specializes in indexing books and creating on-line databases.*



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PC will look at the marketing of the product and explore how its introduction fits into IBM's overall marketing strategy. We'll also determine if and how much TopView slows down other applications.

## TellStar and Journey to the Stars

Two astronomy programs, *TellStar* and *Journey to the Stars*, can help bring the magic of a planetarium into your livingroom on your PC screen. The two programs complement each other; while *TellStar* calculates and displays the locations of planets and stars for any moment you choose, *Journey to the Stars* teaches the neophyte astronomer the fundamental concepts that govern the apparent motions of the heavenly bodies. In addition, *Journey to the Stars* teaches you the names of the stars and the constellations and how to find them in the skies.

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VERSA RECEIVABLES™ is a complete menu driven accounts receivable, invoicing, and monthly statement generating system. It keeps track of all information related to who owes you or your company money, and can provide automatic billing for past due accounts. VERSA RECEIVABLES™ prints all necessary statements, invoices, and summary reports and can be linked with VERSA LEDGER II™ and VERSA INVENTORY™.

### VERSA PAYABLES™

\$99.95

VERSA PAYABLES™ is designed to keep track of current and aged payables, keeping you in touch with all information regarding how much money your company owes, and to whom. VERSA PAYABLES™ maintains a complete record on each vendor, prints checks, check registers, vouchers, transaction reports, aged payables reports, vendor reports, and more. With VERSA PAYABLES™, you can even let your computer automatically select which vouchers are to be paid.

### VERSA PAYROLL™

\$99.95

VERSA PAYROLL™ is a powerful and sophisticated, but easy to use payroll system that keeps track of all government required payroll information. Complete employee records are maintained, and all necessary payroll calculations are performed automatically, with totals displayed on screen for operator approval. A payroll can be run totally, automatically, or the operator can intervene to prevent a check from being printed, or to alter information on it. If desired, totals may be posted to the VERSA LEDGER II™ system.

### VERSA INVENTORY™

\$99.95

VERSA INVENTORY™ is a complete inventory control system that gives you instant access to data on any item. VERSA INVENTORY™ keeps track of all information related to what items are in stock, out of stock, on backorder, etc., stores sales and pricing data, alerts you when an item falls below a preset reorder point, and allows you to enter and print invoices directly or to link with the VERSA RECEIVABLES™ system. VERSA INVENTORY™ prints all needed inventory listings, reports of items below reorder point, inventory value reports, period and year-to-date sales reports, price lists, inventory checklists, etc.

### VERSA LEDGER II™

\$149.95

VERSA LEDGER II™ is a complete accounting system that grows as your business grows. VERSA LEDGER II™ can be used as a simple personal checkbook register, expanded to a small business bookkeeping system or developed into a large corporate general ledger system without any additional software.

- VERSA LEDGER II™ gives you almost unlimited storage capacity (500 to 10,000 entries per month, depending on the system),
- stores all check and general ledger information forever,
- prints tractor-lead checks,
- handles multiple checkbooks and general ledgers,
- prints 17 customized accounting reports including check registers, balance sheets, income statements, transaction reports, account listings, etc.

VERSA LEDGER II™ comes with a professionally written 160 page manual designed for first-time users. The VERSA LEDGER II™ manual will help you become quickly familiar with VERSA LEDGER II™, using complete sample data files supplied on diskette and more than 50 pages of sample printouts.

CIRCLE 260 ON READER SERVICE CARD

### SATISFACTION GUARANTEED!

Every VERSA INVENTORY™ module is guaranteed to outperform all other competitive systems, and at a fraction of their cost. If you are not satisfied with any VERSA INVENTORY™ module, you may return it within 30 days for a refund. Manuals for any VERSA INVENTORY™ module may be purchased for \$25 each, credited toward a later purchase of that module.

To Order: Write or call Toll-free (800) 431-2818 (N.Y.S. residents call 914-425-1535)

\* add \$3 for shipping in UPS areas

\* add \$4 for C.O.D. or non-UPS areas

\* add \$5 to CANADA or MEXICO

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# Some Companies Think Video Adapters Are Like Aluminum Foil On The End Of Rabbit Ears.



## We Don't. At STB We Think Solutions Should Work.

### That's Why We Designed The Graphix Plus II.

Let's face the facts. You need a video adapter for your computer. You don't need the bothersome problems that most often tag along.

When we built the Graphix Plus II we left the problems behind and made solutions the standard feature.

At STB, we think the Graphix Plus II is the only video board you will ever need for your IBM PC,<sup>™</sup> IBM PC AT,<sup>™</sup> IBM XT<sup>™</sup> or compatible. Here's why:

If you use a monochrome monitor, the Graphix Plus II gives you clear, sharp monochrome text and graphics.

If you use a color monitor, the Graphix Plus II matches IBM's standard resolutions for color graphics. But the Graphix Plus II goes beyond the standards. Our video board gives you four and sixteen color modes as well as full screen monochrome graphics with the use of software drivers.

For your convenience, we include drivers for Lotus<sup>™</sup> 1-2-3,<sup>™</sup> Symphony<sup>™</sup> and Framework.<sup>™</sup>

If you use color and monochrome monitors, the Graphix Plus II supports both, and automatically switches display to the appropriate screen.

### The solutions go on...

The Graphix Plus II gives you a parallel printer port, a lightpen interface, 32K of display memory, an optional clock/calendar and STB's one year warranty.

PC Accelerator<sup>™</sup> software, for the print buffering and high speed disk emulation you need, is also packaged with our Graphix Plus II.

### And of course, when you tune in to your favorite program...

You won't be bothered with fuzzy fonts, flickering displays or flashy scrolling. After all, STB creates solutions, not more problems.

When you think of video adapters, think of STB's Graphix Plus II and forget the rabbit ears. Let's keep life simple. For more information about our problem-solving products, call or write STB Systems, Inc., 601 North Glenville, Suite 125, Richardson, Texas 75061. (214) 234-8750.

Keep  
Life  
Simple



**STB**  
STB Systems, Inc.

601 North Glenville, Suite 125  
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(214) 234-8750

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CIRCLE 430 ON READER SERVICE CARD

# Presenting the cure for terminal flicker:

## Tecmar's Color Graphics Monitor

Most color monitors will give you an eyeful of annoying, fatiguing flicker. But not Tecmar.

Our color monitor combines high band width with long-persistence phosphor. So there's no flickering to irritate, agitate and otherwise punish your eyes. Images are stable, even with the most intense colors.

That's quite a breakthrough. But we didn't stop there. Instead, we went on to add a full spectrum of other high-performance features as well.

The Tecmar color monitor is true blue... true red... and 14 other colors.

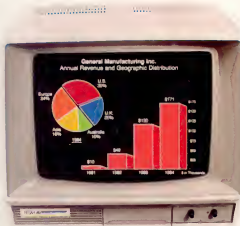
Tecmar's high-resolution monitor gives you 16 different colors to work with. True colors that are never muddy and never hard to distinguish. There's also a Green Only switch for those times when you want to display one-color text on a black background.

Our free PC Paintbrush™ will bring out the artist in you.

The monitor comes with a creative graphics program that will have you making presentation-quality drawings in minutes. You can capture any part of any screen. Then enlarge it. Shrink it. Color it. Dimension it. And send the finished product to as many as 16 different color printers or plotters.

You never have to overreach yourself.

We've made sure you won't have to grope on the sides or back to control on/off, brightness, contrast, Green Only or anything else. Everything is right up front, where it should be. Plus, a LED power-on control lets you know when you're ready to go.



We have great resolve.

Our 13" diagonal screen offers you crystal clear resolution in 640 horizontal by 400 vertical lines. The highest resolution that most PC graphics boards are capable of handling.

Our monitor will work with just about anyone.

The Tecmar color monitor isn't fussy. In fact, it works beautifully with almost any digital RGB source—including the IBM PC.

Our Graphics Master™ and color monitor were made for each other.

The Tecmar monitor gives great performance with existing PC graphics boards. But for even greater clarity and versatility, you can plug in our own Graphics Master board. The board runs with dozens of different software programs, including Lotus 1-2-3™, Symphony™, TGRAF-05™, AutoCAD™ and Metawindows™. And you'll never need an expensive upgrade module to make it work at peak performance.

If you like our monitor, you'll love our price

The suggested retail price for the Tecmar Color Monitor is just \$795. Which makes it as easy on your pocketbook as it is on your eyes.

Tecmar has the finest color monitor in the market. And we say that without a flicker of a doubt.

If you think it's worth a closer look, see your nearest Tecmar dealer for a free demonstration. If you don't know who that dealer is, call us at 216/349-1009 and we'll tell you.

**Tecmar**  
THE POWER BEHIND THE PC

6225 Cochran Road, Solon, Ohio 44139  
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